The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXXVII. September 25, 1937 No. 952

Home Produced Fatty and Essential Oils

MOST of the oils used in industry, other than the mineral oils manufactured from petroleum, are the product of agriculture, and the greater proportion is imported from countries that specialise in that class of manufacture. These oils are obtained by crushing the seeds and squeezing out the oil, or by crushing followed by solvent extraction of the oil, using solvents such as petrol, alcohol, acetone and carbon disulphide, while in some instances the essential oil may be present as a glucoside or in some other form of combination which requires chemical treatment before recovery. The basic fact is that we are largely dependent on other countries for our supply of these oils. Europe excluding Russia produces about 120,000 tons of linseed per annum, Russian production is 800,000 tons; the European production of rape seed is approximately 150,000 tons a year; of sunflower seed 2,500,000 tons (including Russia); of poppy seed 11,000 tons; and of mustard seed some 2,000 tons.

So far as we are aware the British Isles produce none of these seeds commercially. It is not altogether surprising that it should be so for our agricultural land is severely circumscribed in area, and is already totally insufficient to produce the necessary food supply required for these islands. The Department of Chemistry of University College, Cork, through Professor J. Reilly and Mr. D. F. Kelly, has investigated the possibilities of plant production in Ireland. The report which has been published is of a preliminary character, and makes no attempt to indicate the economic possibilities of these crops. The general conclusions are, however, sufficiently favourable to make it desirable that the matter should be followed up, and it is to be hoped that the Free State Government will find it possible to do so. If the land is available in Ireland for the purpose, and the crop yields are as good as the report indicates, it might well be a case where British users of these oils could be of considerable assistance in founding a new industry which will increase the prosperity of Ireland.

What future investigation on the commercial and economic side will indicate it is impossible to say, but the authors state that they believe that the cultivation of linseed would be, from a farmer's point of view, "more or less on a level with oats." The costs for sunflower, poppy, and other seeds "should not be radically different to these from the point of view of ensuring an adequate return to the grower, as well as ensuring that Irish-grown seeds would be available to the Irish extracting and refining concern at prices approaching world market levels. This would make available, to home fatty oil consumers, products *at but little above open market* prices for corresponding oils." The italics are ours, and suggest that at this early stage the economics of the proposals are not without drawbacks. The authors add a little later: ". . . the importance of providing home sources of raw materials of such fundamental importance as vegetable fatty oils would appear to be a sufficient reason to justify the existence of a subsidy, if found necessary, for these crops."

The German Fat Monopoly regulations are quoted with approval in this connection, and it would appear that economic nationalism is playing a large part—some would say too large a part—in this investigation. It is mentioned that in 1933 the area planted with linseed in Germany was compulsorily increased from 27,500 acres to 300,000 acres, which under favourable weather conditions would produce up to 80,000 tons of linseed, having an oil content officially taken as 26 per cent. Actually the production of linseed in Germany expanded greatly during the period 1933-1935, being 3,187 metric tons in 1933, 6,334 tons in 1934, and 16,000 tons in 1935. These oils, of course, are used for human food (margarine), for cattle feeding (in the form of cakes or meal), for soap manufacture, for paints and lubricants, and (in the case of colza oil) for lighting. It is also possible that semi-hardened poppy-seed oil could be used as a substitute for cotton-seed oil. We in this part of the British Isles are beginning to displace cattle cakes by dried grass, but otherwise we have to import some £30,000,000 worth of artificial cattle foods annually. It has been stated that with artificial grass-drying a farm can be self-supporting in foodstuffs. This movement does not affect oil production, but it may have a very pronounced effect on fatty oil disposal.

The essential oil problem appears to be even worse, since it is recorded that it is difficult to obtain even limited supplies of suitable plants or expert advice on the proper procedure for cultivation and subsequent harvesting or sale. Oils of lavender, dill, chamomile, peppermint, rosemary, to mention only a few, have been produced for many years in Lincolnshire and Cambridgeshire, and *metha piperita*, the source of peppermint oil, has been grown at Mitcham, in Surrey, since 1750. Numerous medicinal plants and herbs are grown and harvested at a number of South of England farms, and it is believed by the authors of this monograph that lavender, peppermint and dill oils would be suitable for growing in Ireland. Lavender and peppermint are in point of fact being cultivated at nurseries at Mallow, and the plants have been distilled successfully in a semi-scale plant at University College, Cork. These essential oils, while valuable and useful, have not the same commercial and economic importance as the fatty oils. It seems doubtful whether any of these agricultural products will be grown on the large scale in this country, though conditions might be more suitable in Ireland.

Notes and Comments

Process Operation

A MARKED tendency in the modern operation of chemical processes on the manufacturing scale is the elimination, as far as possible, of any rule-of-thumb methods in the measurement and adjustment of the working conditions of the process, upon which the whole success of the operation can depend. For the most part the lesson has been learnt, not without costly experience in some cases, that the initial expenditure on instruments designed to record, and often control, temperature, pressure, humidity, flow, and other conditions influencing the course of the manufacturing operation, is amply repaid in the rigid check which is thereby placed on those factors which can make or mar the process. The plant accessories, a generic term which covers anything which is not essential to the manufacturing operation, are therefore, paradoxically enough, so highly desirable in most processes that they are looked upon as absolutely essential by an increasingly large section of the chemical industry. Apart from plant accessories for process control, there are accessories to be installed for safety purposes and for use in case of accident. Here again, this type of accessory should also, by right, be considered essential, but, judging by the Factory Inspector's recent report, this ideal state has not yet been reached.

Progress in Plant Accessories

THIS issue of THE CHEMICAL AGE is devoted to the subject of plant accessories. It contains articles on the measurement and control of process variables in chemical plant, dealing with the selection and maintenance of recording and controlling instruments; general safety considerations in operating chemical plant, with special reference to centrifuges, pumps, stills, and autoclaves; and the practical observance of safe working conditions in chemical works. Details of some of the new plant accessories which have been introduced on to the market are also given. These include industrial measuring and controlling instruments, humidity controllers, and valves.

Anti-Gas Training

AN index of the importance attached by the Government to civilian anti-gas training is provided by a Home Office air raid precautions memorandum, published by the Stationery Office. The memorandum summarises the more important information which has already been issued by the Air Raid Precautions Department. The thoroughness with which the work is undertaken is realised by the news that a second school, for training instructors to teach members of air raid precautions services and the general public, will be opened at the end of this year. The syllabuses for local anti-gas training and public anti-gas instruction are comprehensive, and it is emphasised that the training should include the wearing of a respirator in tear gas. The gas is used either in a fixed chamber or specially adapted motor vans, of which there are forty available. It is comforting to note that in the regulations governing the admission of trainees into the chambers of these gas vans, it is laid down that "the driver will stand at the foot of the ramp to give assistance to persons in the chamber, or leaving it hurriedly, as required." Many conflicting opinions have been put forward in estimating the loss of life which could be caused by a gas attack and the necessity for widespread anti-gas training, provision of so-called gasproof rooms, etc., and while the effects of gas attacks are generally overrated, it is far better that they should be so, rather than underrated.

A Cause of Cancer?

THE September number of *The Engineer of India* contains an article by David Brownlie in which he endeavours to substantiate the thesis that the cause of cancer is to be found in the products of high temperature carbonisation. The evidence upon which this suggestion is based rests on the one fact that certain substances contained in high temperature tar are known to cause cancer under certain conditions. It is also noted that non-cancerous petroleums can be made cancerous by subjection to high temperatures. The suggestion is not new, for the National Smoke Abatement Society has noted that since coal smoke contains tar, the abolition of smoke may assist in the abolition of cancer. Unfortunately for the suggestion, however, Brownlie shows that deaths from cancer are increasing rapidly, whereas the work of the Smoke Abatement Society and others in that field has caused the atmosphere to-day to be much more free from smoke than it was of old. In 1911-1915 deaths from cancer in this country were 1,055 per million, and in 1934 they were 1,563 per million; between 1911 and 1934 the old London pea-soup fog was abolished. Brownlie makes the further, and quite unique suggestion, that since town gas is a product of high temperature carbonisation, the increase in cancer is due to cooking in gas ovens! He admits that carbon monoxide cannot cause cancer. How the heavy constituents of tar can escape the gas purifying system, travel sometimes for miles along the mains, and then pass unchanged through the process of combustion is, we confess, beyond us as chemists. No evidence is adduced by the author to substantiate his theory. Again facts are unkind to him. Between 1911 and 1934 the efficiency of the gas cooker has so increased that incomplete combustion in a modern cooker is now unknown.

Vitamin D in Cacao Shell

THE publication of a booklet edited by A. W. Knapp, chief chemist of Cadbury Bros., Ltd., draws attention to the valuable properties of a by-product material. The booklet contains accounts of the researches which have been carried out on "Vitamin D in Cacao Shell" during the last few years. Dr. Coward and A. W. Knapp showed in 1934 that cacao shell contained at least one quarter of the vitamin D content of cod-liver oil and accordingly had an unusual value as a cattle feeding stuff. Other investigators found that the vitamin D in the cacao shell consumed by cows was largely conveyed to the butter and it thus became possible to produce butter in winter with a vitamin D content equal to that of summer butter, a desirable result of national importance. Cacao shell also had the valuable action of increasing the butter percentage in the milk without affecting the quantity of milk produced. Here is another instance of the profitable utilisation of a by-product.

Process Variables in Chemical Plant

Their Measurement and Control

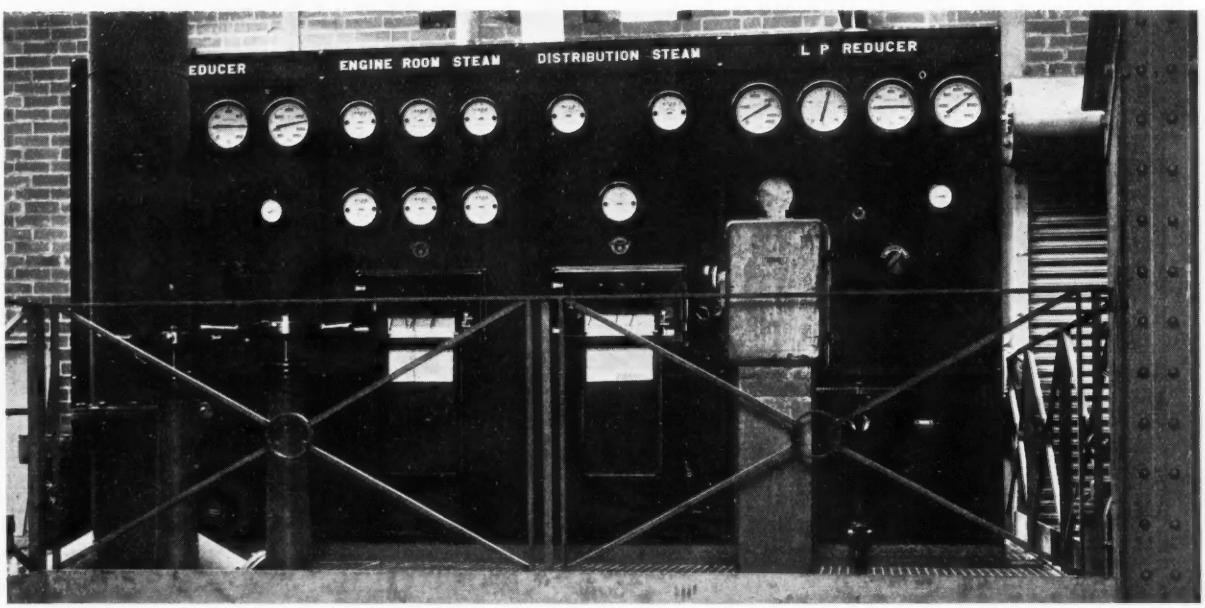
By

" CONSULTANT "

IN order to operate at the highest efficiency, chemical plant as we know it to-day relies very largely upon keeping the process within certain defined limitations of temperature, pressure (or vacuum), rate of flow, liquid level, hydrogen ion concentration, and other variables, assuming that the constructional materials of which the plant is built and the engineering details of design have been properly considered. In other words, chemical engineering operations, in nearly all cases, involve the measurement and control of one or more variables which depend in number and type upon the complexity of the operation which is the object of the plant. Various instruments are obtainable to measure the variables which have been mentioned, but these instruments do not merely indicate when plant conditions are correct for efficient working; they also provide means for keeping the process safe against such hazards as fire, explosion and the leakage of dangerous vapours. When mere measurement is combined with a device to control automatically any particular variable, for example, rate of flow of the liquid which is being processed or steam used in the processing, a still wider usefulness is attained. In addition, by recording continuously one or more variables, the plant user will have useful practical data from which exact conditions can be repeated on subsequent occasions, and also for computing certain items in production cost. A study of this recorded data, moreover, will reveal plant operating faults so that they can be corrected, and, if necessary, methods of operation may be varied to give better conditions of manufacture or to modify the quality of the ultimate product. Process variables, therefore, can be measured, permanently recorded upon suitable charts, and also automatically controlled. The three groups of instruments are separately known as indicators, recorders or recording indicators, and controllers, various combinations of the three main functions being possible, such as an instrument which indicates and records, indicates and controls, or indicates, records and controls the variable which it measures.

The utility of the measurement and control of variables in the operation of chemical plant cannot be valued too highly, because the use of an instrument avoids possible errors of judgment on the part of the man who is operating the plant. Even a simple device which is mechanically sound in design is better than nothing at all for the purpose of regulating some particular variable, a typical instance being the rate at which liquid enters a vessel or the rate at which solid material passes to a grinding mill. On the other hand, it is quite easy for chemical plant to be encumbered by the adoption of too many measuring and controlling devices which are recommended for use by their makers. Just what process variables it is desirable to measure and control on a particular plant is a matter which must be decided when the value of each of these variables has been carefully assessed; there are, of course, general cases where it is obvious that measurement and control is desirable, as with temperature in distillation processes or pressure, and also temperature, in the case of an autoclave. When it comes to the question of selecting a suitable instrument, however, the potential user does not find it an easy task for he can be very much bewildered by the variety of instruments which are detailed in the catalogues and leaflets of makers. Not only do limitations apply to the use of certain patterns of instrument, but there are also many refinements in actual design and construction which greatly affect the accuracy of that instrument in a particular application—especially accuracy over a long period of use, with possible ill effects from particular sources of strain and shock to which the instrument may be subject in the course of carrying out its designed function.

It is not every variable which will require separate control, even though it be measured and indicated and possibly also recorded, because the adjustment of other conditions in combination may have the effect of holding it within the desired limits. In a boiler which produces dry saturated steam, for example, the control of the pressure will automatically provide for a supply of steam of a definite temperature, but to maintain the pressure, the rate at which heat is added to the



A well-planned and readily accessible panel of recording and controlling instruments for automatic steam pressure reduction and desuperheating, installed for Imperial Chemical Industries, Ltd., by Electroflo Meters Co., Ltd.

boiler must be equal to the rate at which heat is withdrawn in the form of steam. In consequence, in addition to the regulation of pressure, the rate at which fuel, air (necessary for the combustion of the fuel) and water (as raw material for the making of the steam) are supplied must also be subject to control. If a particular variable is important for the operation of the plant its recording will be worth while irrespective of whether control is effected by manual or automatic means. An automatic controller becomes specially desirable if the variable is liable to fluctuate either widely or rapidly, and particularly in cases where any such fluctuation may affect the success of the process. Speaking generally, the true worth of automatic control by means of a group of instruments and operating devices must be assessed on a basis which is purely economic, and it must not be overlooked that as much may be overdone as left undone.

Considerations of Cost and Upkeep

It is when the type of control has been settled that the specific method which is to be adopted comes up for consideration. Here the determining factor is mainly the balance of suitability against initial cost and upkeep. The chemical engineer, however, is fortunate in that the available instruments cover a fairly broad range in their accuracy, reliability for keeping in good order, and cost. It is not always the most expensive instrument which will be found the most satisfactory in the long run, because a certain proportion of the cost may have been incurred by providing some minor technicality in design which may be very desirable in one case and yet of no advantage whatever in another case. Where the failure of an instrument might be particularly hazardous it is desirable to install duplicate instruments, and this is another reason for keeping an eye upon initial cost. Actually there are very few instruments on the market which can be really regarded as unsatisfactory in operation, because the making of instruments is a highly specialised job and the reputation of the maker would quickly suffer if cheap and very unsatisfactory instruments were placed on the market. Nevertheless, the manufacturers do endeavour to provide instruments at slightly different prices to suit users whose purpose may be fulfilled quite well by omitting small refinements in construction, with sometimes very great saving in cost.

Value of Automatic Control

A trend for generally increasing the output of chemical plants is now encouraging the wider use of a great variety of controlling devices, both automatic and semi-automatic, to make the process continous. This continuous processing has two important advantages. It makes large scale production easy, and at the same time more or less guarantees that the output of the plant will be uniform in quality—both in physical condition and in chemical composition. Where the flow of materials is rapid, however, the controlled conditions have to be especially exacting, and here is a typical instance where the measurement of variables must be particularly accurate and the instruments which are installed must be of the highest reliability against loss of accuracy or failure. Automatic control, as such, possesses several advantages from the point of view of processing, almost irrespective of what unit operations are involved. Measurement of variables is a question of detecting differences; the differences affect the quality of the product and the smoothness with which the process operates. It is the immediate response of the instruments to variations within the range of their operation which is the main advantage of installing automatic controllers and their accessory devices. Slight variations of temperature or pressure, for instance, may have important effects upon the output of the plant, and in those cases where the adjustment of conditions is left to the man in charge it is always possible that he may not be quick enough to notice troubles until damage is done. This state of affairs is especially important where a continuous process is in operation. On the other hand, a controlling instrument will give immediate response to any changes and immediately compensates the trouble. Quick response to changes becomes especially important with increased speed of output, because, in a continuous process, variation from standard for one minute or less may produce sufficient "off-standard" material to "de-grade" a much larger batch of the ultimate product, in the manufacture of which the plant in question may provide one unit operation.

Accuracy, of course, is the first essential of all indicating, recording and controlling instruments. The actual devices which are operated by the controller should be simple in design in order that they may respond quickly and to the degree required, and they should also be easy to adjust when the necessity arises. It is the small pilot valve which simplifies the task of keeping the flow of liquids and gases at a definite value, or in controlling the rate of flow of a liquid or gas in one pipe at some definite ratio with the rate of flow in another pipe, and for such a purpose as that of maintaining volume and liquid level in absorption towers and distilling columns.

Importance of Maintenance

If measuring instruments are to do what is intended of them they must be kept in good working order. In other words, they must be accurate and remain accurate, or their true purpose will be frustrated. If many instruments are installed it is wise to have their accuracy checked by the makers at regular intervals, a so-called servicing contract being made for the purpose of testing the instruments *in situ* on the plant and adjusting them when occasion arises or repairing them in any respect if necessary. The frequency of inspection should be left at the discretion of the makers of the instruments; in most cases one call every three months should suffice and, indeed, is desirable. Such testing, of course, can be done by the user if there is someone sufficiently competent to do this and if apparatus is available, *i.e.*, apparatus for testing pressure gauges, a lead or salt bath for pyrometers, a tank for calibration of liquid flow meters, a pitot tube for flow of air and gases, and an anemometer for checking the air delivery from a fan. In any case it is desirable for the maintenance engineer to be acquainted with the nature and general construction of the instruments which are under his care, and for this purpose users of instruments will find that their engineer will benefit by a visit to the instrument makers' works, where facilities will be readily given to see instruments in course of manufacture and under test.

Upon the question of maintenance it is very desirable to have detailed advice from the makers of the instruments, and, with this advice kept in view, no person should touch an instrument except for any necessary maintenance work, and even then the person should be one who is familiar with the installation of instruments. Inaccurate measuring and recording arise mainly as the result of tampering by inexperienced persons; one person should therefore be made responsible for all instruments which are installed at the works, whether there are only a few or many, and it is this person who should always have the task of removing charts when necessary and making any adjustments which are required.

The most accessible place on the plant is generally the most desirable for the installation of any instruments. In an accessible place they can be seen easily by the man in charge and the changing of charts or the making of adjustments is not hampered. At the same time the "accessible" position should be chosen carefully, for it is obvious that there should be no risk of damage to the instruments by the movement of process men, fitters, or by any portion of the plant which may have to be hoisted in the course of repairs. Located as near as possible to the usual station of the man in charge is most desirable, because he will then consult the indicators and recording charts very frequently.

Charts from recording instruments should be examined and compared at regular intervals; only by doing this is it possible to make proper use of them. Comparisons should be made with records obtained on previous days and in previous years, and every variation should be investigated with the object of knowing why it occurred and whether a variation in one variable coincided with a change which is noticeable in

one or more variables which are likewise recorded. Indicating and recording instruments provide facts, and these facts collected over a long period of time become a valuable asset for studying plant conditions. The data which they provide allow the course of operating conditions to be checked, so that any abnormal conditions which have arisen on one particular occasion or at frequent intervals can be easily detected and corrected. For instance, from the examination of such charts it is possible to discover an excessive and unnecessary use of steam or cooling water, due to careless operation or other causes. Wasted steam, of course, must be rigidly avoided so that process costs are reduced. Abnormal happenings, considered generally, give indication of either defective plant, dirty plant or conditions which are liable to be hazardous.

Progress in Instruments

Modern improvements which have been made in indicating, recording and controlling instruments have been mainly concerned with the attaining of greater accuracy, a greater degree of sensitivity or immediate response in use, and in the provision of patterns to meet special conditions of usage. In addition, there has been a noticeable trend to give data of different kinds upon one and the same chart in order to facilitate the study of that data. For instance, instruments which record two or more variables on one uniformly graduated chart—say pressure, water level, and rate of flow—are especially useful, because successful process operation depends upon the accurate and co-ordinated knowledge of the various factors which are involved. A quick comparison of fluid flow with such related factors as pressure, temperature, liquid level or ingress of air, as in the case of boiler plant operation, is always desirable; indeed, no better example of the general use of control instruments exists than that which is provided in the case of a boiler which is producing dry saturated steam. Multipoint and distant indicating instruments have also been more widely used.

As to the necessity for recording instruments, consider again the case of steam, where steam costs are important costs, and merely ask two questions: First, do you know *what* you are getting for these costs? Second, do you know *where* the steam is going and *which* parts of your plant are using it to its *best* advantage? Only by knowing this is it possible to make savings in the boiler house and in every steam-using unit at the works. Heat-using processes of whatever nature they may be should always be recorded, preferably to show rate of flow so that the most efficient boiler operation is possible, and also to show steam flow in unit volumes, and the time at which it was produced or used at any part of a twenty-four hour period. In this way steam production and distribution can be effectively analysed, and used in conjunction with temperature, pressure, liquid level, and other data, to give a co-ordinated and balanced system of process control.

The alkali industry presents many important applications of the use of automatic control instruments in the operation of lime kilns, absorption towers, filters, salt cake furnaces, ammonia recovery units and related plant which is designed to operate at a high rate of flow and maintain a heavy output. Consider, also, the case of a metallurgical works, for no industrial operation is more exacting in its temperature requirements than the heat treating of metals. Each metal and each alloy has its own set of temperatures and conditions of furnace atmosphere, which have to be rigidly observed to obtain desired results. In addition, to the degree of temperature there is also the necessity of making sure that exact temperatures are not overstepped, and this makes it desirable to regulate the rate at which the temperature increases.

Some Recent Developments

The last few years have shown the ingenuity of the instrument designer in his attempt to meet all the demands of providing a record of plant process variables, and for controlling these variables. For instance, the number of industries which now depend upon an accurate and continuous knowledge of hydrogen ion concentration is very large, and here there is an ever increasing demand for a record of results and the automatic operation of valves and other devices to ensure uniform conditions. The continuous measurement and control of these *p*H values is obtained by electrical recording instruments which work on a potentiometric principle. These instruments are widely adopted for the reason that precise degrees of acidity or alkalinity can exert a marked effect upon the yield and quality of the product in so many processes of a chemical nature, which are distributed throughout different industries. A recording potentiometer, with automatic temperature compensating devices, can be arranged to control a valve for the addition of the correct amount of a particular solution which is necessary for processing. Photoelectric cells can be used to detect and also regulate devices which arrest turbidity or change of colour, in cases where a solution may be so affected to the detriment of the ultimate product. Portable draught and pressure indicators are now obtainable for works where there are furnaces, retorts, flues, drying tunnels, and ducts which convey hot air to drying rooms. Boiler feed water is effectively and accurately measured by means of recorders in which the feed water passes over a V-shaped notch before entering the feed pump and so actuates a recording lever by the rise and fall of a float. There is, indeed, no limit to the number of cases which could be mentioned where recent invention has been applied to the design of measuring and controlling instruments.

Compressed Gases in Canada

Production during 1936

THERE were 28 Canadian factories engaged in the production of compressed gases, including oxygen, acetylene, carbon dioxide and hydrogen in 1936. The total capital invested in the industry was $4,565,549, and the 568 persons employed earned $823,714. Production value totalled $3,360,220. The output of oxygen increased 11 per cent. to 15,600,660 cu. ft.; acetylene, 3.5 per cent. to 11,315,830 cu. ft.; carbon dioxide in cylinders 10 per cent. to 5,318,656 lb. and hydrogen, 0.4 per cent. to 40,313,740 cu. ft. Aqueous and anhydrous ammonia, solid carbon dioxide, nitrogen and nitrous oxide were the other products of this industry. A number of Canadian factories classified in other industries also had a production of gases. For instance, liquid chlorine and synthetic ammonia, acetylene, nitrogen and pintsch gas are turned out in factories classified in the acids, alkalies and salts industry, fertilisers industry, and artificial gas industry.

Cotton Cellulose

Manufacture to be Started by New Company

A NEW company is being formed to operate the Holden Wood Bleaching Co.'s plant at Haslingden. The Holden Wood concern is a subsidiary of the Bleachers' Association, Ltd. The new company is to be called the Holden Vale Manufacturing Co., and it has been formed by the Bleachers Association in conjunction with the Hercules Powder Co., of Wilmington, Delaware, and elsewhere in the United States. This company are well known as producers and distributors of chemicals, drysalteries, etc., for the textile, soapmaking, and other industries, one of its products being a chemical used for imparting a permanent softness and whiteness to cotton cloth. The Holden Vale concern will manufacture cotton cellulose—or "chemical cotton," as it is sometimes called in the United States—by bleaching and otherwise treating cotton waste and linters. Cotton cellulose has uses in the textile industry as a raw material for the manufacture of rayon and also in the explosives, plastics, and other industries.

Safety Considerations in Operating Chemical Plant

By
A. G. WRIGHT

ALTHOUGH safety in the operation of chemical plant is very greatly promoted by the use of temperature and pressure indicating instruments and automatic devices to control the flow of materials, steam, cooling water, etc., common sense combined with a good knowledge of chemicals and conditions involved is no inconsiderable factor. It is this need for care in some of the simpler terms of " doing this and that " which has been primarily responsible for the formulation of special safety rules at large works where chemical plant is employed. While such rules must always include matters of technical significance, many commonsense features are generally well in evidence, and the need of them is emphasised by occasional outstanding negligence in spite of a warning that " safety rules are drawn up in the interest of employees who should read them and remember them." General rules which are applicable to all employees include such matters as a reminder that " a large leakage of benzol makes it necessary to turn off all gas burners on stills, furnaces, etc., *at once*," and that " sand will do much to prevent an oil fire from spreading." Even in the category of personal safety it is still necessary to remind plant employees that " goggles *must* be worn where there is danger from corrosive liquids or hot liquids, for example, caustic soda, sulphuric acid, and hot oils."

Reporting Faults

So far as the process itself is concerned, the need of common sense is again reflected in instructions which point out that " it is *necessary to report any faults* in the supply of steam and electrical current," and also any noticeable defects in the operation of accessory machinery, slackness or signs of wear on driving belts, the sticking of valves, and joints on vessels and pipes which show signs of leaking or corrosion. All of these points are equally important, because they are all likely to give rise to accidents which may involve fatalities. Any suspicion of escaping gases or vapours, which may be evident from slight difficulty in breathing or by a noticeable dizziness at the end of the shift also needs investigation and calls for urgency in being reported; in spite of this advice, however, plant employees may become so familiar with slightly unusual atmospheric conditions that nothing more than physical fatigue is considered to be responsible.

One of the most outstanding features of accident statistics is the extent to which the human factor is revealed as an important cause. Hazardous operations, as such, are responsible for a very small proportion of accidents, and when cases of " gassing " are counted in comparison with cases of physical injury due to falls and slipping, it will be found that the ratio is at least 1 to 25. Some slight failure of the human element, due either to momentary neglect or varying degrees of carelessness, is generally responsible for 90 accidents out of every 100, taking the case of industry generally, and at chemical works this state of affairs is not greatly changed except for conditions which are peculiar to the nature of the unit operations which are involved. The unsuitability of the individual for his work is often a fruitful cause of accidents; on the other hand, a long and monotonous familiarity with some particular type of plant may be equally responsible for dangerous conditions arising. All employees should properly understand the principles which are involved in the operation of the plant, as well as its operating technique and the chemical and physical nature of the materials which enter into reaction or processing. The investigation of many accidents at chemical works has revealed the fact that a high proportion are due to lack of proper instruction and, secondly, lack of proper supervision.

In order to ensure the attainment of safe operation the supervising chemist must have a good knowledge of the characteristics of the materials which are being used, and of the effect of these materials—alone and in combination—upon the health of employees who are engaged on the plant. He must also have a knowledge of the effect of these materials upon plant constructional metals, etc., and upon the continuity of operation, as well as a knowledge of the operating principles and the preferred operating sequence, and the consequences of alterations in that sequence. Safety is not a matter which must be emphasised periodically; it is only attainable by the conscientious assumption of responsibility on the part of the chemist in charge of the plant. Information upon apparatus, wearing apparel and safety devices can be secured at all times by a perusal of the catalogues and leaflets which are issued by the makers of protective equipment and plant accessories, but the intelligent use of these things can be enforced only by strict supervision.

It is lack of attention to small details that is often the cause of troubles arising. For instance, the tearing of the packing by the slightly rusted stem of a valve on plant working at high pressure may make it difficult to open or close the valve in an emergency, quite apart from the fact that the risk of leakage is also increased. Care must be taken to see that high pressure valves are firmly secured in position, otherwise the leads will be subjected to unusual stresses when operating the valve. With valves which need frequent re-packing it is also a wise precaution to provide for a vent to allow the gas to leak beyond the upper seating; this prevents accidents arising when the bonnet is removed and there is nothing left to hold the packing in place.

Attention to Centrifugals

Taking another case, special care still needs to be emphasised in the operation of centrifugal dryers. As a major precaution the maximum speed which has been specified by the maker should never be exceeded. A machine which has been in service for some time and is operating above its specified speed, or is overloaded, becomes especially dangerous; it may suffer mechanical injury and become unbalanced. Increased speed should not be used to meet the case of a product from which moisture is not readily removed. If a product cannot be dried sufficiently by " whizzing " it for one minute at the top speed obtainable on the centrifugal, the duration of whizzing should be increased.

To prolong the life of the basket and thereby prevent it from becoming mechanically weak due to corrosion, it should be made a regular practice to wash the basket thoroughly and then dry it at top speed for one minute on each occasion when work has been completed for one day, or at the end of each shift when the centrifugal may remain idle for an hour or so. Corrosion of a centrifugal basket will definitely reduce the safety margin in respect of operating limits; all baskets, therefore, should be inspected periodically. In the case of a steel basket it is desirable to make this inspection once every two weeks after the basket has been in use for six to eight weeks; copper baskets should be examined once every four weeks after being in three months' service, and stainless steel and monel metal baskets should be examined once every eight weeks. During an inspection it is necessary to note any signs of bulging, evidence of the thickness of the shell having been reduced, and any increase in the diameter of the perforations or a change in shape from circular to elliptical.

It is generally unwise to feed a slurry to a centrifugal basket while the machine is running, when the basket is not properly supported from below or if the spindle of the machine is not a sturdy one. Centrifugals which are equipped with a spring mounting, however, will usually allow a considerable degree of unbalance without causing undue strain on the foundations. When a basket has need of repair it is

essential for this work to be done by the makers, or alternatively by a firm which is already experienced in the repair of centrifugals, for only where appliances are available to obtain proper dynamic balance will the repaired basket be satisfactory when again in operation. An unbalanced basket on a machine which is running at top speed is easily able to wreck the machine, and in doing this it can cause serious injury to plant employees who may be near.

Accidents with Pumps

Pump accidents can be caused indirectly by leakage, corrosion, and mechanical fracture of the pump casing, and there are two possible hazards which have to be guarded against. On the one hand, the liquid which is passing through the pump may cause injury by coming into contact with an employee; it may also cause a fire or explosion if it be of inflammable or explosive nature and conditions are favourable for ignition. On the other hand, mechanical fracture of the pump, possibly attended by an explosion, may bring injury from flying fragments. Of the two hazards injury from the liquid which is being pumped is the most common. The leakage of liquid at the gland of a rotary pump will give rise to a fine spray, and, where the liquid is caustic soda or an acid, an employee can be badly burned and even blinded. If the gasket gives way the pressure which is exerted by the pump may easily force a stream of liquid over a distance of several feet, where it may come in contact with a spark or flame and so cause a fire or explosion, quite apart from the ever-present danger of personal injury. Leakage of a serious nature can also be caused by continued conditions of corrosion on the pump casing or on the discharge pipe, especially in cases where periodical inspection has not been carried out and has therefore failed to reveal a possible source of trouble. This hazard from corrosion is far more common than might be anticipated, because corroded parts of the pump casing may give way without warning, due to sudden fluctuations in pressure or the operation of a valve which has a tendency to stick. A sudden leakage of this type may cause several hundred gallons of liquid to be showered over men and materials before emergency means can be adopted for stopping the stream.

The glands on centrifugal pumps which are handling dangerous liquids should be shielded and drained if possible; in addition, the pump casing should be shielded to hold back any liquid in cases of accident. Where a definite fire hazard exists the pump should be installed in an isolated room and driven by a totally-enclosed electric motor of an approved flame and explosion proof type. If extremely high pressures are used a suitable barricade should be erected around the pump, even when it is housed in a separate room, because flying fragments can be a serious menace even if accidents are infrequent. Leakage from the gland of a pump, in the case of a highly volatile and inflammable liquid, may easily cause the accumulation of an explosive mixture of vapour and air around the point where the pump is operating, and this may be the start of the trouble. The generation of static discharges is another source of danger, especially in the case of volatile liquids which often have relatively high electrical insulating properties; the static discharge is generated by the pump impeller in its normal act of rotating in such a liquid and the presence of dissimilar metals is favourable to its generation.

Priming Pumps

Another word of warning must be given in regard to priming. If a centrifugal pump has dropped its suction it should never be primed whilst running by admitting liquid through the discharge pipe, because the resulting shock can strain the pump itself as well as the coupling and also injure the motor. Where a pump is continually dropping its suction, the cause will be found to be due to air being drawn into the casing through the gland, or at a leaky joint on the suction pipe. If a pump rattles when in operation it is commonly due to the presence of air in the pump casing, and it is wise to remove this air by means of the air cock which is provided, as soon as the trouble is noticed. Pumps which are to handle a heavy inflammable solvent may be wisely erected over a shallow pit which contains water, as any leakage at the gland —which may be common in certain circumstances—will then sink harmlessly to the bottom of the water instead of accumulating on the floor around the pump where fire risks are possible due to static electricity or heat which is generated in the pump bearings.

Operation of Stills

Consider also the case of safety in the operation of stills, with fractionating columns, condensers and receiving tanks. On such a plant it is very desirable to inspect all safety valves before proceeding with the distillation of each intermittent batch of material; where the process is continuous safety valves should be inspected at the commencement of each shift. Stills and condensers must be steamed out before starting up, when the plant has been shut down for any length of time. In the case of inflammable materials, stills should be coupled to an empty tank, so that the contents of the still can be run off in the case of an outbreak of fire. Still residue tanks, moreover, should be kept empty in order to make it easy to run down in the case of a leakage. In many cases stills should not be re-charged until one hour has elapsed after discharging. When parts of the plant have to be opened for repairs or for inspection, it is necessary to steam out stills, fractionating columns, condensers, and receivers, and after blanking off the steam and vapour connections water should be run down the fractionating column before the joints are broken. If compressed air is used for blowing liquids other than acids, the pressure should not be greater than 20 lb. per sq. in.

Precautions with Autoclaves

Autoclaves, which are commonly used in the manufacture of dye intermediates, because pressure may be indispensable for the progress of the reaction or may give a more favourable yield, are typical as a type of equipment which demands special safety precautions. They may be provided with a steam jacket where relatively low temperatures are concerned, or with an oil jacket for use at high temperatures; in other cases they may be heated direct by gas burners. Here, as an essential accessory, the pressure gauge should register fifty per cent. more than the maximum reading which is normally required, and all gauges which are in use should be tested at regular intervals. Such a gauge must be provided with an ample length of thread on the connecting socket and must be securely locked in position to give a gas tight joint; unless this is done no reliance can be placed on the readings of the gauge. In addition, each leg of the syphon tube to which the gauge is attached must be of ample length for the movement of the column of mercury, protected at each surface level by a small quantity of thick mineral oil of a quality which will not be affected on the pressure side by any vapours which are produced inside the autoclave. Precautions as to gas-tight joints apply equally to the thermometer pocket, which must be sufficiently long to reach below the surface of the liquid charge in order to avoid faulty readings of the temperature upon which the safety of the operation largely depends. The cavity between the thermometer and the walls of the pocket is filled with either mercury or oil.

In the case of an autoclave which is heated direct from gas burners, care must be taken to see that the centre of the hemispherical base of the autoclave is not in the direct play of the flames, for it is at this point that the movement of the charge due to stirring is at its slowest rate and there is considerable risk of burning. In the case of a vessel 3 ft.6 ins. diameter the flames of the burners should avoid the area within a radius of about 9 in. High-power burners which are supplied with gas from a slow rotary blower, at a pressure of 6 to 8 lb. per sq. in., demand the very desirable precaution of providing a small pilot jet for each burner in order to avoid explosion troubles when the burners are lit. Local overheating can be minimised by careful attention to the air

supply, which must be cut down—as deemed necessary—by air adjusting discs, although it is fully realised that burners work more economically if they are using their power supply of air. Long handles for all gas valves are a great advantage in making easy adjustments to the flame.

Handling Exothermic Reactions

Where an exothermic reaction is involved special precautions must be taken, because a sudden generation of heat with a consequent increase of pressure may be a serious strain upon the strength of the vessel, joints at flanges, and the efficiency of valves, pressure gauges, and the glands through which the stirring gear is operated. A definite knowledge of the approximate minimum temperature at which the evolution of heat will commence is very desirable; this information should be obtained with the use of a small experimental autoclave previous to working up large batches. Safe working is then made possible for the simple reason that burners can be extinguished as soon as a certain temperature is reached, and in the case of a steam-jacketed autoclave the steam supply can be shut down with the same object in view. In the production of *p*-nitraniline *o*-sulphonic acid, which is a typical exothermic reaction, practical operating data indicate that the burners may be full on until the temperature reaches 132°, with a pressure of 160 lb. per sq. in., then decreased to half their full capacity until the temperature has risen to 137° and the pressure has increased to 175 lb. (taking about 15 minutes), and finally extinguished. Under these conditions the temperature and pressure during each successive 15 minutes will be found to rise automatically to 140° (185 lb.), 143° (195 lb.), and 149° (220 lb.), and then fall to 148° (205 lb.), at which point the burners are relighted and suitably adjusted to maintain the heat necessary for the remaining course of the reaction.

Special attention should be paid to the joints at the charging hole; nuts must be tightened with a spanner which properly fits them, and the final tightening should be done when the temperature of the charge has risen to 110°. The packing of the stirrer gland also requires careful attention, otherwise it will be difficult to maintain a gas-tight condition. Metallic packing made from anti-friction lead alloys should be used where processes involve the use of ammonia or soda under pressure. The risk of an involuntary stopping of the stirring gear and the consequent settling and burning of the charge is greatly minimised by the provision of a non-slipping belt for power transmission and by inspecting the belt periodically. For autoclaves which are operating at high temperature, however, a silent chain drive is preferable. Speed of stirring is adequate to prevent localised burning if the stirrer moves round the internal walls of the autoclave at linear speeds varying from 11 to 14 feet per minute.

Consideration of Plant Design

Careful attention to the design of a plant will always go a long way towards making the process safe, provided that there is a full knowledge of the process and the nature of the chemicals which are involved. At the same time that means are provided to prevent the escape of a dangerous liquid or vapour, it is also necessary to provide a method for dealing with an unforeseen escape by way of a suitable by-pass; in the case of a fire arising there must be means for shutting down the plant and discharging the contents of vessels to a position of safety. Cleaning and inspection must be made easy, for many accidents—especially gassing accidents—follow the removal of a manhole cover. Gassing, however, is often associated with the risk of fire and explosion; the vapour of benzol, for example, readily forms an explosive mixture with air as well as a poisonous atmosphere.

The dangers of static electricity arise mainly in the pumping of liquids, in the discharge of a liquid from a vessel or a pipe, and in the movement of belts and certain types of machinery such as grinding, disintegrating and sifting machines. Where there are serious fire risks a flameless method of heating the reaction mixture is advisable, although this may not be convenient or even attainable if temperatures are relatively high. When open flame burners are used the dangers may be considerably reduced by enclosing the burners in a separate chamber, which is so arranged in its position relative to the vessel and in the provision of the flues, that any escaping liquid or vapour cannot come into contact with the flame. A previous mention of static electricity should also remind plant employees that this can be generated by the flow of hydrogen gas through the nozzle of a pipe connected with the cylinder. With a cylinder of compressed oxygen the chief danger arises as an explosion when the oxygen comes in contact with organic substances, especially by the presence of oil or grease upon the cylinder valve, or by connecting the cylinder to pipe-work which is contaminated with grease.

Open-top tanks and vessels which contain hot, corrosive or otherwise dangerous liquids, should be so erected that there is adequate gangway alongside them, possibly completely round them, in order to minimise any danger of employees falling in or being splashed during the agitation of the liquid or while the liquid is being run into the tank. In such situations, valves, belt shifters, clutch levers, and other controlling devices, should be located, at least three feet from the edge of the tank, unless they are provided with an extension to allow them to be operated from a similar distance. Protection against damage by splashing or overflow is also important. In cases where other equipment is installed beneath the tanks, a liquid-tight semi-floor should be provided, complete with a low wall and provision for draining any leakage or overflow to a safe point.

Liquids can be moved about the works by pumping, by flow under action of gravity, and by air pressure. Of these three alternatives, air pressure is the least desirable, and should not be used for dangerous liquids if one of the other two methods can be applied; pumping is preferable to gravity flow. The increased use of inflammable liquids in chemical manufacture and in the application of chemicals in industry gives rise to an extended risk of fire and explosion due to the accumulation of vapour by leakage or other causes. In this connection, however, users of such liquids are fortunate in being able to obtain inflammable vapour indicators which give readings in terms of the lower limit of the explosive range for different vapours, and where possible such indicators should be adopted.

The Chemists' Exhibition

New Products of Interest

THE Chemists' Exhibition which was held at the Albert Hall, London, S.W.7, last week, closed yesterday. This exhibition is, of course, concerned with products for retail sale by chemists and druggists, but nevertheless contained a few new exhibits of wider interest. Sharp and Dohme, Ltd., showed solution S.T.37 (hexylresorcinol) which is a stable, non-toxic, non-irritating germicidal solution claimed to destroy pathogenic bacteria in less than fifteen seconds contact. Among the more recent introductions made by Parke, Davis and Co. is Mapharside (*m*-amino—*p*-hydroxy—phenylarsine oxide hydrochloride), an arsenical of high spirochaeticidal power and low toxicity.

A new ampoule filling and sealing machine was shown on the stand of Johnsen and Jorgensen Flint Glass, Ltd., which covers all sizes from 1-10 c.c. and the various types of ampoules. Ru-Mari, Ltd., exhibited Tyrodone, a preparation in tablet form from a concentrated extract of oysters which contains organic iodine and other minerals. It is said to be superior to liver in the treatment of anæmia. Among the developments of Beatson, Clark and Co., Ltd., were a new moulded screw cap for small bottles containing volatile liquids, such as ether; cut-in indestructible labelling for glass bottles and jars, the letters being vitreous enamelled in white or black; and a screw cap bottle provided with a separate pouring lip so that a sharp liquid cut-off is obtained without dripping.

Fire and Other Risks in Handling Petroleum Products

Safe Working Conditions at Carless, Capel and Leonard

By
F. A. JACKSON

THE firm of Carless, Capel and Leonard owns several factories in the East London area, where products of petroleum and coal tar covering a wide range are distilled, refined and blended. The highly inflammable nature of most of the goods handled makes it obvious that the fire risk is a pre-eminent one among hazards for which precautions have to be taken.

As a protective measure of prime importance the firm maintains a trained voluntary fire brigade, affiliated to the London Private Fire Brigades' Association. The members of the brigade comprise selected individuals from all branches of the staff, regular drills are held and competition work is encouraged. It should, however, be emphasised that the duties of the private brigade in case of fire are primarily of a first aid nature, isolating the outbreak and preventing its spread until the arrival of the municipal brigade. It has been found by experience that portable two-gallon fire extinguishers of the foam type, applied as close to the seat of the fire and as early as possible, are most effective, and at all important points in the works these are available. Some methyl bromide hand extinguishers are also used, and all the road vehicles belonging to the firm are equipped with one of these two types. In addition to the portable extinguishers, fire hydrants are set at convenient points about the factories, and an important part of the scheme is a dual water supply, some hydrants being connected to the public mains, while others are tapped from the firm's own cooling water system. This water is pumped from the canals by feed pumps connected to a separate steam supply, and thus is unaffected by any breakdown in other parts of the steam mains.

Safeguarding against Fire

On the factory premises no-smoking rules are rigidly enforced, and all smoking materials belonging either to employees or visitors have to be left at the gates.

Each department is capable of being shut off from those adjoining by means of heavy iron fire-resisting sliding doors, which have the temporary effect of keeping a fire within bounds and give time for the brigades to get to work. None of these doors is fitted with fusible links, so that it would not be possible for men to be trapped within the building. Each building is also arranged with its floor in the form of a saucer, so that in case of outflow or serious leakage of spirit, it is retained within the building.

The layout of the factories has been given the most careful consideration, and no highly inflammable products are stored or manipulated anywhere in the vicinity of the boiler houses. The method of storage adopted for these products is, with the exception of a limited number of service tanks above ground, to keep them in mild steel vessels of varying shape and size below the ground level, this having been found to be eminently satisfactory after years of experience. All vessels used for storage or handling of spirit are tested for soundness before installation, the severity of the test varying from 5 lb. per sq. in. air pressure to as much as 200 lb. per sq. in. of kerosene, according to the service for which the vessel is required. The underground tanks are themselves surrounded with a layer one foot thick of well-puddled clay, which forms an impermeable covering, and also has the great advantage of protecting the steel from external corrosion. Very slow internal corrosion sometimes occurs, and can be checked by the application of a protective paint which is insoluble in petroleum and coal tar products.

The underground storage method is interesting from the point of view of actual exposure to fire. Each tank is provided with a round manhole, 18 in. in diameter, with a heavy cast iron lid, having a 3 in. plug hole and plug. This manhole is set in a well of concrete, 5 feet square and 3 to 4 feet deep. This well can be flooded with water, and with the manhole cover and plug in position forms a complete insulating seal for the tank and its contents. The efficacy of this system of storage has been amply demonstrated on the very few occasions when a fire has occurred, when despite a fierce conflagration and the burning of stock above the ground, the contents of the underground tanks, including some very volatile fractions of petroleum, have been left untouched.

Waste Interception

It is necessary to ensure that none of the oily waste products from the refining processes reaches the public sewers, and the method of dealing with this is to provide a series of traps, or interceptors, where the waste, sometimes emulsified with water or reagents, is allowed to settle and is separately removed. These interceptors consist each of a number of chambers linked up by means of siphon pipes so that the lighter liquid is trapped in the first chambers, allowing the effluent water to pass on to the sewer. In the event of a serious plant breakdown resulting in a heavy flow of inflammable material to the drains, valves can be instantly closed so that no liquor leaves the premises.

A possible source of fire which has received considerable attention is the generation of static electricity caused by the friction due to the passage of spirit through the open ends of hoses. In the factory itself there is no danger in this respect, since the plant is earthed in the ordinary course of erection, but when tank lorries are loaded for delivery purposes, great care has to be taken to ensure that the tanks are properly earthed by means of cables temporarily connected to sockets provided. Lack of this precaution has elsewhere on occasion caused serious explosions. Another safety measure taken in connection with road tank waggons is the fitting to each compartment of two valves, the outer valve on the outlet pipe and an inner emergency valve. This latter must be opened before any liquid can leave the tank, and to ensure that it is in working order the practice is to load waggons with the emergency valve only shut, the outer valve remaining open.

In certain departments, notably those where filling of vessels for sale is carried on, it has been possible to provide a measure of automatic protection. Where service tanks above ground level are used for filling purposes, the outlet pipes include valves which close by the action of a weight when a retaining fuse string is broken by the application of a flame. In the case of these tanks the outlet valves are always placed as close as possible to the tank itself without any intervening length of piping. The cooling effect of the contents of the tank will then protect the valve in case of fire.

Precautions with Electrical Equipment

Among the minor problems which have had to be studied is the question of the inter-departmental automatic telephone. In the distilleries, where the concentration of highly inflammable vapour may be large, instruments of the totally-enclosed mines type have been installed.

The many electric circuits for power and lighting in the factories have been arranged so that each department is wired independently from the distribution boxes. Each circuit has a Megger insulation test applied at regular intervals, and early indication is obtained of incipient faults which are remedied before they develop further. Vapour tight light fittings are used throughout the area where inflammable material

is stored, and all switches and fuses are placed outside this area.

The employment of electric power is now engaging greater attention. Until a few years ago power plant was entirely steam operated, but electric motors and switch and starter gear of flameproof type, bearing the Buxton certificate, are now installed for certain duties. The latest section of the refinery erected by the firm is now all-electric, and it has been possible here to instal at various points emergency stop switches. As in this part of the plant spirit is chemically treated under considerable pressure, it is of great advantage to be able to stop the whole plant instantaneously should a fault arise. This would have taken some little while, even if the operators could have done so without danger to themselves, with the older steam-operated plant.

Great care is taken at all times to prevent accumulation of inflammable vapour. All buildings have to be thoroughly ventilated directly to the outside air, and no artificial heating can be employed. When it is found necessary to enter any vessel for cleaning or repair purposes, all vapour is first removed by steaming out, and a certificate of freedom from inflammable vapour is obtained. In any case where a tank or still has to be entered without these precautions being observed, the men entering are obliged to wear a gas mask supplied with external air, together with a safety sling, and it is the special duty of men outside the vessel constantly to tend both the air line and the life line.

Protective ointment is available for all men who handle any material, either reagents or products, which may affect the skin.

All moving machinery is protected with the usual guards, in accordance with regulations and general good practice.

In the case of oil-fired boilers, used very largely for process work, experience has shown the desirability of fitting stabilisers in the flues to prevent blowbacks.

Chief among the purely chemical risks encountered are sulphuretted hydrogen and sulphur dioxide. Sulphuretted hydrogen is removed from coal tar products by chemical treatment, and care is taken that the waste liquor is thoroughly removed before any accidental spillage of acid can re-liberate the gas. The internal drainage system is also specially ventilated to ensure that any accumulation of gas is immediately dispersed to the atmosphere at a high level.

Sulphur dioxide is often formed when strong sulphuric acid reacts with the unsaturated hydrocarbons in the various spirits. The vessels in which this action takes place are hooded at all outlet points, and the vapours are drawn away by turbine-driven fans. Another source of this gas was found in the distillery, where, at the end of a charge, it was customary to blow live steam through the plant to cleanse it. In the course of the cleansing the steam acted upon a heavily sulphonated residual oil, liberating considerable volumes of sulphur dioxide. In consequence of this, in certain cases live steam has been dispensed with, and compressed air substituted for the purpose. Before any part of the distilling plant is opened for examination or repairs, however, great care is taken to saturate thoroughly the whole of the interior with wet steam, to avoid possibility of explosions due to the accumulation of iron sulphide.

An interesting modern development in the petroleum world is the addition of lead tetra-ethyl to motor and other spirits to improve the anti-detonating properties. The lead tetra-ethyl fluid itself in concentrated form can poison the operators engaged in blending it with spirit, either by contact through the skin, or by the vapour being inhaled, and they are therefore protected thoroughly from both these risks. Gas masks and special clothing, consisting of white woollen underwear, white overalls and caps, and rubber aprons, gloves and boots are worn.

The white clothing is important because the fluid is brightly coloured with dye, so that a spill on the clothing can be detected immediately. In this event the mixing is stopped and the operator concerned must remove the clothing affected, wash himself with kerosene and finally take a bath with soap and hot water. In addition the whole of the personnel is periodically medically examined as an extra precaution and to ensure that those engaged in this work are, and keep, perfectly fit and free from any personal idiosyncracy.

Canada as Sulphur Producer

Recovery from Smelter Gases

SULPHUR of 99.5 per cent. purity is now being produced at Trail, B.C., Canada, at the rate of over 45 tons daily. This sulphur comes from the smelter gases which were formerly discharged into the air and which were long regarded as a liability and nuisance because of their destructive effect on the surrounding vegetation.

In an article in a recent issue of the *Bulletin of the Canadian Institute*, R. Lepsoe and W. S. Kirkpatrick explain the process whereby sulphur gases arising from roasting the lead and zinc concentrates from the ores of the Sullivan mine are turned into pure sulphur and sulphuric acid.

The Trail smelter treats about 6,500 tons of ore a day of which about 5,000 tons are wasted to the mill tailings dump, and while now valueless will in future be used as a source of sulphur and iron. This is equivalent to 1,500 tons of sulphur and 2,200 tons of iron each day. In the concentrates about 400 tons of sulphur remain and it is part of this sulphur that is being recovered at present. Briefly, the process consists of concentrating the sulphur dioxide in gases in the fumes by means of liquid ammonia and sulphuric acid, whereby pure sulphur dioxide is produced. By passing this through a bed of highly heated coke in a special type of furnace with pure oxygen liquid sulphur is produced. It is later pumped to a flaking plant or allowed to solidify as large blocks for shipment.

At present 50 to 60 per cent. of the sulphur in the gases is recovered either as sulphuric acid, or pure sulphur. Last year Canada imported 168,774 tons of sulphur, crude or in roll or flour, valued at $2,802,000.

Photographic Emulsions

Use of Gelatine Dissolved Cold

THE preparation of satisfactory photographic emulsions from gelatine dissolved in the cold has been achieved by Steigmann (*Koll. Zeit.*, 1937, *80*, 217-219), by the use of urea. It was found that urea can cause the solution of quite considerable quantities of gelatine in cold water—preferably at about 25° C. Thus 20g. of gelatine will dissolve in 50 cc. of water in the presence of 30g. of urea.

In preparing the emulsions the gelatine is first dissolved in a small quantity of water at 25° C. containing sufficient urea to bring about solution, and this concentrated solution is added to the halogen salt solution, which is then mixed with the silver nitrate in the ordinary way. The concentration of the gelatine is arranged to be 6-8 times that of the standard Abney peptisation medium, as the weaker emulsions contained a considerable amount of coarse silver bromide. The emulsions thus prepared ripen well and are very stable.

It was observed that a concentrated urea-gelatine solution, when diluted with water at 18° C., gelled much more rapidly than the same solution diluted to the same extent with water at 45-70°, and then cooled rapidly to 18° C. From this it is concluded that the dissolving action of the urea is due not so much to a hydrolysis of the glutin to polypeptides and amino-acids, as to a simple disaggregation of the glutin, an effect which is to a large extent destroyed by diluting in the cold.

A comprehensive range of raw materials will be turned out at the new acetic acid works of Dainippon Celluloid K.K. They include acetic anhydride, cellulose acetate, acetone, butyl acetate and ethylene glycol.

Safety in a Chemical Works

By

J. C. STEWART, B.Sc., Safety Officer, Scottish Dyes, Ltd.

THE maintenance of safe and healthy working conditions is a problem which must be approached from many angles. In this article I shall attempt to describe how one firm attacks it.

Scottish Dyes, Ltd., belongs to the Dyestuffs Group of Imperial Chemical Industries, Ltd. The works, which is situated at Grangemouth, Stirlingshire, employs about 500 workers in the manufacture of dyestuffs based on the anthraquinone molecule. The materials used include some which have toxic properties and some of these are capable of being absorbed through the skin. Some are highly inflammable and others are corrosive. The plant includes agitated pans, vats, stills and agitated high pressure autoclaves.

A survey of all the chemicals used or produced has been made. In conjunction with the Works Medical Officer the literature available was examined and a report made on the hazards connected with each. Copies of this report were distributed to the heads of all departments and to those in charge of production. Addenda are made when required.

In such a works the obvious approach to the problem of safety is that of securing good plant design. Where noxious fumes are liable to be evolved the vessels are draughted to the open air, and if this is not sufficient the plant is moved to a lean-to annexe to the manufacturing building. The handling of corrosive liquids and solvents is cut down as far as possible by storing them in vessels outside the building. They are conveyed by pipe line to suitable measuring vessels and delivered to the reaction vessels in closed pipes. All moving parts within reach are guarded.

The failure of the "human element" is so frequently the explanation given when accident causation is investigated that an improvement in the type of workers employed is clearly an important step towards safer work in the factory. The fundamental approach to this aspect is the careful selection of workpeople. At Scottish Dyes, Ltd., all successful applicants for situations as labourers, boys as well as men, must pass a series of tests for prospective process workers. These tests, which were specially devised for us by the National Institute of Industrial Psychology are described in *The Human Factor* for November, 1935. They have proved of great value. Indeed, of the 97 who passed the test and have been engaged, none has been discharged as unsuitable.

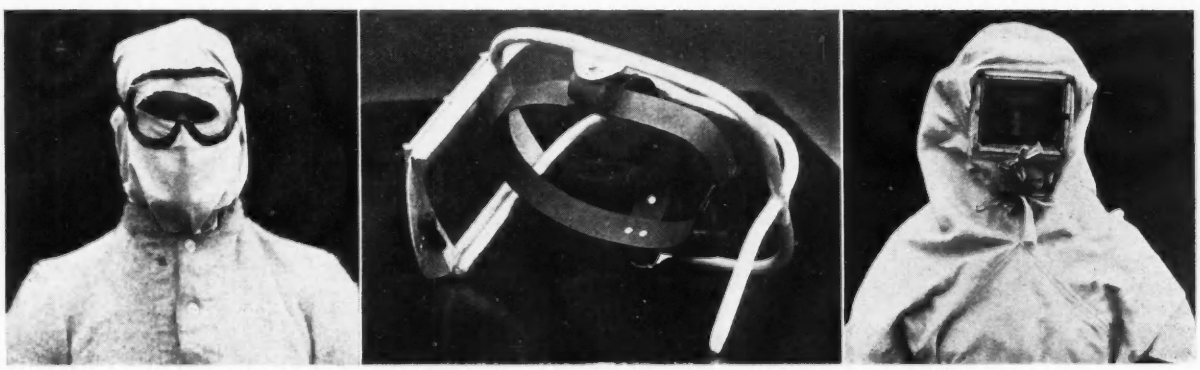
The men selected are then medically examined by the Works Medical Officer. This examination includes an eyesight test. In this connection one wonders how many accidents have been due to defective vision. It is a simple matter to test the sight of applicants and advise those who require spectacles to get them. This is a precaution which the smallest firm can take.

On engagement the successful applicant is conducted by one of the senior foremen to the museum. Here he is shown samples of materials used in our processes, and is given demonstrations of the effects of acids on clothing. Fire hazards are also demonstrated and the moral—the need for good housekeeping—is emphasised. The foreman also shows how to use the Grangemouth Mask, and how to trundle casks filled with solids or liquids. The museum is housed in a disused annexe to a shed and many men have expressed their appreciation of it. Indeed, old employees have been heard to say that had they been shown the samples they would never have taken the foolish risks which they had taken. This procedure is also followed with fitters and other tradesmen on their engagement.

Boy labourers are trained in the laboratories and on being transferred to the works, spend their first six months in the care of picked process workers.

Each employee is given a small safety handbook which is attractively printed and well illustrated. Now it is recognised that no matter how attractive these booklets are made there is a danger of their being laid aside and forgotten. In order to counteract this arrangements have been made whereby every foreman has a discussion with his squad on the subject of safety once per month. These talks occupy not more than fifteen minutes on a Saturday morning. They are based on the safety handbook and the men are invited to draw attention to practices which they consider unsafe. This development has not been in operation for many months, but already its usefulness has become apparent.

While none of the processes in the works are scheduled under Chemical Works Regulations, we have voluntarily placed ourselves under these in certain cases. For example, men working on processes involving the use of nitrobenzene are provided with a complete outfit of clothing including shirt, vest, pants, socks, woollen tunics and trousers, and rubber boots. These are washed in the works laundry, clean clothing being provided each week. This clothing is stored in a messroom which is equipped for this purpose with two locker rooms, one for working clothes and one for outdoor clothes. The reason for this wholehearted attack upon nitrobenzene poisoning is that without this scheme a man is liable to go home in clothes contaminated with volatile solvents. If he sits in front of the fire in a room with very little ventilation almost the worst possible conditions come into existence. Furthermore, all those men who are supplied with this clothing sign an undertaking to take a bath at the end of every shift and a bath register is kept. The danger due to absorption through the skin is thus greatly minimised. The Works Medical Officer visits the works every Friday afternoon and examines men employed on such processes according to a rota. If a man shows the slightest symptoms of poisoning, or even if he is only slightly below par, he is transferred to other



Two masks devised by Scottish Dyes, Ltd. Left: a dust hood; centre: the framework of the Grangemouth mask; and right: the Grangemouth mask as worn.

work temporarily as a precautionary measure. The foremen have been taught to keep an eye on the condition of their men and send them for special medical examination if necessary.

Protection against Dermatitis

Dermatitis is a formidable enemy and determined efforts have been made to provide adequate protection for the hands. The standard equipment of the process worker includes cotton gloves worn inside rubber gloves. The purpose of the cotton gloves is mainly to absorb the perspiration which is itself a solvent for certain deleterious chemicals which might find their way into the rubber gloves. Moreover any contamination of these cotton gloves can be seen and the gloves washed. Before putting on the gloves a skin protection cream is applied to the hands and wrists. This is water soluble and is washed off at meal times. It is freshly applied from dispensers fixed to the wall besides the exist from the messroom. Rubber sleeves reaching from the wrist to the elbow are also worn. Recently we have supplied a number of men with ankle-high rubber boots and they have proved much more popular than the ordinary " Wellington " type. Some of these have also reinforced toe-caps to prevent injury to the toes from falling objects.

Several types of goggles have been tried, but the standard for our process workers is a non-inflammable celluloid goggle which is comfortable, effective and not readily lost. The only drawback hitherto has been the old problem of dimming. It seems that at last we have solved this difficulty. We have been experimenting with a solution which when rubbed on the goggles effectively prevents them from becoming dimmed even when the operator is perspiring freely as a result of his exertions. Bottles of anti-dimming compound are now provided in boxes on the walls of the sheds, each bottle being equipped with a sprinkler top so that the contents can be shaken direct on to the goggle and smeared over it with a sponge.

Types of Masks

The masks used may be divided into five categories :—

1. Dust respirators.
2. Dust hoods.
3. Fresh air breathing apparatus.
4. Grangemouth masks.
5. Oxygen breathing apparatus.

The dust respirators used are of a well-known make and consist of a rubber face piece covering the nose and mouth. Renewable filter pads are carried in a bakelite frame and a double valve is fitted so that inhalation only occurs through the filter pad and vitiated air passes through the non-return outlet valve.

The dust hood is an interesting innovation brought into being for a special purpose. The Works Safety Sub-Committee on one of its periodical tours of the works drew attention to a man shovelling caustic soda from the floor to a pan. He was performing this operation in a confined space in the neighbourhood of a heated pan. The heat and labour caused him to perspire freely, and he complained of irritation of the forehead and neck due to the caustic dust. The works medical officer, who is a valued member of the Safety Sub-Committee, suggested that we might as an experiment provide the man with a hood similar to that worn by a surgeon when performing an operation. A " surgeon's hood " was therefore made by taking a piece of suction filter cloth 26 inches by 34 inches and making a slit six inches long twelve inches from the narrow end. The cloth was worn over the head with the slit in front of the eyes. Over this non-inflammable celluloid goggles were placed. This simple device has proved very effective when used with the anti-dimming compound already mentioned, and is now scheduled for use on processes creating caustic dust clouds.

The Grangemouth mask consists of a fibre headpiece carrying an aluminium frame. To this is attached a hood of light woollen filter cloth. Compressed air is supplied from the mains through a filter and reducing valve and a length of 5-16 in. bore welders unkinkable rubber tubing. A stream of cool air is directed across the large non-inflammable celluloid visor. The mask is light, cool and comfortable and affords protection against absorption of noxious gases through the skin. This type has been approved as fulfilling the requirements of the Chemical Works Regulations, 1922.

Oxygen breathing apparatus of a well-known make is kept for general rescue work. The transfer of protective appliances from one worker to another is not allowed, and all such articles must be fumigated before being issued to a new wearer.

Great help is given by the Safety Sub-Committee of the Works Council. This consists of three management and three workers' representatives with the Works Safety Officer as secretary. The works medical officer also attends the meetings of the committee. In addition to its regular monthly meetings this committee makes tours of the works and draws attention to dangers which have escaped the notice of the shed supervision. Its recommendations, being the considered opinion of both workers and staff, are almost invariably adopted. While the Safety Sub-Committee is encouraged as much as possible, it is made clear to all those in charge of manufacturing processes that the responsibility for the safe working of those processes is theirs and theirs alone. All safety and prophylactic measures are carried through primarily by the production chain of command. Whatever measures are employed, assistance or advice given through service sections, nothing is done to divorce the responsibility from the plant superintendents, foremen, etc., directly engaged in controlling works operations.

Need for Reporting Minor Accidents

A guide to the need for precautions is provided by the reports of minor accidents. The management insists on the reporting of all accidents no matter how slight. Men are instructed to go to the ambulance room to have every cut attended to. There an accident report form is initiated and the foreman and superintendent in charge are required to state what action is to be taken to prevent a recurrence, if action is considered necessary. This may seem an over-elaborate procedure. Actually we regard it as of first importance. Not only are trivial defects frequently contributory factors in serious accidents, but the procedure ensures that steps are taken to prevent a recurrence at any points in the works. Also accident statistics lose much of their value if some accidents are not included. The Safety Sub-Committee considers all these reports of minor accidents and so gets a bird's-eye view of the situation. For example an undue proportion of accidents when using hand tools suggested that an inspection of these would be worth while. An inspection was undertaken and an astonishing proportion of defective tools was discovered.

In the event of a serious accident or near accident a court of enquiry is set up. This consists of the works manager or his deputy, the head of the department concerned and the Safety Officer, who acts as secretary. Additional members may also be appointed. If the injured workman is able to be present at the inquiry he gives his evidence first, beginning at the site of the accident, and remains while all the other evidence is given. The witnesses then leave and the court arrives at its decision in private. The verdict of the court is made public whether that verdict is that the management is responsible or not. The court also recommends the action to be taken to prevent a recurrence.

Accidents reported as having occurred at other works often show the need for additional precautions and these are discussed by the Safety Sub-Committee. One such case concerned a series of accidents to men working on roofs and chimneys in the neighbourhood of chemical plants. The men were overcome by fumes and fatalities were narrowly avoided. The committee suggested that men should not be allowed access to the roof of any shed without a permit signed by a responsible person certifying that there was no danger from fumes coming either from that or neighbouring sheds. This sugges-

tion was adopted by the management and is now in force.

Certain parts of the works are scheduled as dangerous areas and flame-proof lighting equipment is installed. In these areas special non-sparking tools are provided and ordinary steel chisels, jumpers, etc., can only be used on receipt of a written permit. Under chemical works regulations, of course, permits are required before entering closed vessels. The same forms are used for access to roofs, use of sparking tools and use of flames in sheds.

Importance of Good Lighting

The lighting of works using continuous processes is obviously of considerable importance. In making alterations to the layout of a plant the need for alterations to the lighting is apt to be overlooked. Such errors can best be revealed by an *ad hoc* examination of plants in working conditions. Difficulty has been experienced in finding a suitable paint which will stand up to the fumes, but a light grey bitumastic paint has been found which gives good reflection without glare. The walls are whitewashed for the same purpose.

Good lighting encourages good housekeeping, and good housekeeping is an excellent means of avoiding danger to health, danger of accidents and danger of fire, as exemplified by spills of noxious materials, obstructions of passage ways and litter. Competition between the sheds has been successful in maintaining interest in good housekeeping. An inspection committee of three, consisting of a senior foreman, a worker and the safety officer makes unexpected visits to sheds and records and passes to those in charge the reasons for the marks lost. The foremen and men enter into the spirit of the competition, and there is remarkably keen rivalry for top place. Combustible rubbish, non-combustible rubbish and scrap metal are kept in separate brick bins outside the sheds and points are lost if any material is found in the wrong compartment. Points are deducted for spillage, steam leaks, obstruction to passage ways, etc. A handicap system is employed to give a fair chance of winning to the larger sheds.

A suggestion scheme provides for a steady flow of safety suggestions. Those which are adopted gain a minimum award of ten shillings for the submitter.

Safety Propaganda

Posters supplied by the National Safety First Association are conspicuously displayed and renewed each month, and these are of value in directing attention to specific points. Also safety slogans are printed on the pay envelopes, but of greater value as general propaganda is a notice board showing how many lost-time accidents there have been in each department and how many days have elapsed since the last one. Nothing succeeds like success, and when this number approaches or passes one hundred it seems as if the whole works is safety minded. Our record was 182 days which was equivalent to 669,215 exposure hours. Comparing 1936 with 1931 the number of lost time accidents per annum has fallen from 52 to 14; the frequency rate from 3.79 to 1.32; the severity rate from 740 to 410; cases of dermatitis from 6 to 1; nitrobenzene poisoning from 9 to 0, and fires necessitating the works fire brigade from 14 to 0.

New Plant Accessories

Humidity Controllers for Severe Operating Conditions

BY producing a new range of humidity controllers, which can operate under the most severe operating conditions, Short and Mason, Ltd., have satisfied a long felt want. These instruments are obtainable as direct reading combined temperature and humidity recording controller, direct reading indicating humidity controller, direct reading recording humidity controller, and direct reading humidity recorders or indicators. They are fitted with special humidity elements unaffected by temperature variation, operating on a magnified link motion which immediately transmits humidity changes into pen arm action. The membranes retain their characteristics for considerable periods without the necessity for constant adjustment, thereby giving the user an advantage in comparison with the conventional types of hair operated instruments which need constant attention. The instruments are suitable for operation in both high and low temperature zones.

A new type of indicating Fulscope controller has now been introduced, in response to the demand for high quality air operated controllers for those applications where a record is not required. The dominant characteristic of this controller is flexibility of design and performance. Fitted with the "Fulscope" mechanism it contains all the features of the recording controller, providing for the first time in any controller an infinite number of sensitivity values. A simple screw driver adjustment will obtain the type of control required, *i.e.*, throttling or on-and-off action. It is thus possible to adjust the controller on site for the time lag of the process, consequently overcoming "hunting" control which results when controller sensitivity and process time lag are not timed together.

A range of flow and liquid level instruments has also now been placed on the market. Operating on the manometer principle with orifice flanges, these controllers have the additional advantage of being fitted with the "Fulscope" mechanism so that it is now possible to have a complete range of instruments for humidity, temperature, pressure, flow, and liquid level control with identical mechanisms and principles of operation, differing only in their means of actuation. This feature ensures interchangeability of parts.

A Staybrite jacketed pan made recently by Thompson Bros. (Bilston), Ltd. It is of the shallow type, 5′ 5″ at the top rim, and constructed by means of the company's patent jacket joint.

Improvements in Industrial Measuring and Controlling Instruments

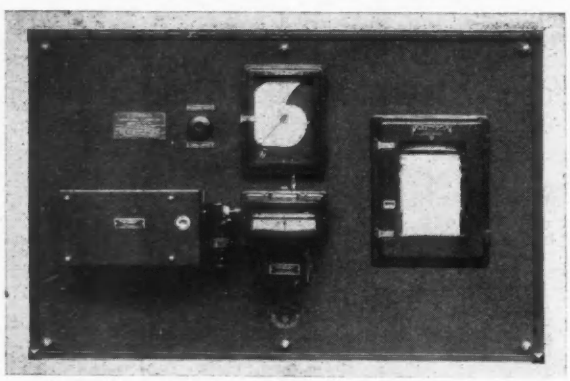
FOR years Electroflo Meters Co., Ltd., have been extending gradually their range of industrial instruments so that to-day it covers almost the whole field.

The range of Electroflo electrical flow meters has been recently supplemented by three new instruments. These are the micro-mechanised mechanical flow meter and two ring balance meters, the one electrical and the other mechanical. Models of each are available for indicating, recording and integrating or combinations of these. The mechanical meter is distinguished by the simplicity of its design. The float lever, its spindle and the pen arm form one rigid assembly; the only other moving part being the float itself. Backlash is thus eliminated and a special grease packed gland reduces friction to a negligible minimum. Integration on this instrument and on the mechanical ring balance meter attains the remarkable speed of 1,000 units per hour enabling short period tests to be carried out with unimpaired accuracy. This is made possible by a special clock driven integrator mechanism which imposes no load on the meter mechanism and is not dependent in any way on a friction drive.

The electrical ring balance meter is the first of its kind to require no working force for the transmitter. A standard Electroflo resistance element suspended from the ring forms part of the necessary control weight and dips into a fixed well of mercury. The electrical reading instruments are available in ten different combinations of integrator, recorder and indicator.

Programme Control Pyrometer

The Electroflo Programme Control Pyrometer is the latest development in automatic control for furnace work, for applications where a temperature-time cycle has to be followed instead of just maintaining a constant temperature. The accompanying photograph shows a three-point programme con-



Electroflo three-point programme controller with separate recorder.

troller with separate recorder. The control cam is cut to provide the temperature-time cycle required and automatically adjusts the control index to follow this. By means of a mercury switch commutator, the three thermocouple and contactor —or valve regulator—circuits are connected in turn to the controller so that three zones of a single furnace are independently adjusted to the required cycle. In this way a heat treatment can be carried out involving a predetermined though not necessarily steady rate of heating, allowing for pauses at critical temperatures, followed by a soaking period at a predetermined temperature with, if desired, provision for an alarm at the conclusion of the cycle. All this is carried out automatically, and can be repeated time after time with absolute precision, yet without the necessity for adjusting valves or dampers, or in any way supervising the process except to discharge and recharge the furnace.

The extensive range of Electroflo indicating and recording expansion thermometers, both with and without alarm contacts, has been augmented by the introduction of similar instruments fitted with air-operated control mechanism. There is no actual contact between the thermometer mechanism and the control mechanism, yet by an ingenious device the air pressure applied to a diaphragm type valve is varied precisely and instantaneously in accordance with the temperature reading. These instruments can be adapted for programme control so as to follow a complete rubber curing cycle or for other similar processes. Pasteurising of milk and beer, or cooking of foods are typical applications where a constant temperature is required and can be maintained by an Electroflo air-operated controller. Complete processes can be automatically regulated in this way so as to eliminate the human factor and attendant uncertainties.

The Electroflo Regulators, Series 50 and 60, which can be applied to pressure, flow proportioning, speed, level and combustion control, combine the four desirable properties of a regulator in a manner not hitherto achieved. In spite of their apparent incompatibility, power and sensitivity, speed and stability have all been combined and are all independently adjustable so that the characteristics of the regulator can be modified to suit the plant conditions exactly. Two outstanding applications of these instruments are automatic steam pressure reduction and desuperheating. The latter application employs the evaporation method and, without any mechanical or thermostatic devices, atomises and evaporates the required quantity of water which is maintained strictly in proportion to the steam flow at all times. These instruments have been developed to cope with the increasingly high boiler pressures and temperatures employed to-day, and the consequent need for greater accuracy in pressure reduction and desuperheating equipment.

Measurement of Smoke Density

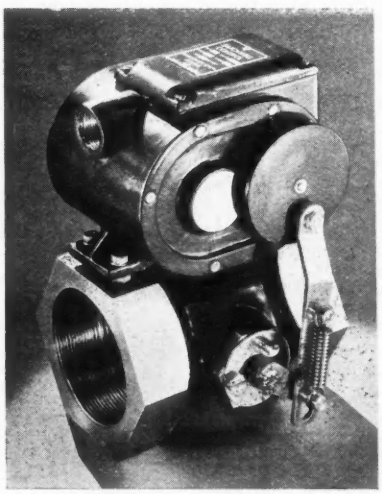
The measurement of smoke density, though apparently simple, is fraught with considerable difficulties. Experience has shown that, to obtain reliable results, many by no means obvious precautions must be taken. Research, however, has now enabled these difficulties to be overcome with the result that smoke density indicators and recorders are obtainable. A self-generating photo-electric cell is used which eliminates the need for amplifiers and their associated thermionic valves. The calibration is, therefore, permanent and a special device is used to emilinate errors due to fluctuations in supply voltage. Care has also been taken in the construction to make provision for keeping the windows and lenses clean.

Detecting Explosive or Irrespirable Gas-Air Mixtures

A NEW line of gas indicators, developed for quickly and easily detecting explosive or irrespirable gas-air mixtures, is announced by the Linde Air Products Co. These instruments are designed to fulfil the requirements at petroleum refineries, chemical works and gas works for determining hazardous conditions in manholes, oil storage tanks, conduits, tunnels, etc. On the UCC combustible gas indicator, Model 12-B, a graduated meter scale indicates by direct reading whether combustible gases are present, and, if they are, whether concentrations are above, within, or below explosive limits. For increasing the utility of this instrument, a flame-type safety lamp attachment is available which makes it additionally possible to detect oxygen deficiencies. The UCC all-service indicator, Model B-1, shows the presence of combustible gases, indicates an oxygen deficiency, and, in addition, includes a toxic chamber for determining the presence of carbon monoxide and hydrogen sulphide in dangerously toxic concentrations. Both of these instruments are equipped with a patented air dilution valve, by means of which incoming samples can be diluted with any volume of air, thereby making it possible to detect dangerous conditions which might not otherwise be indicated due to a lack of oxygen.

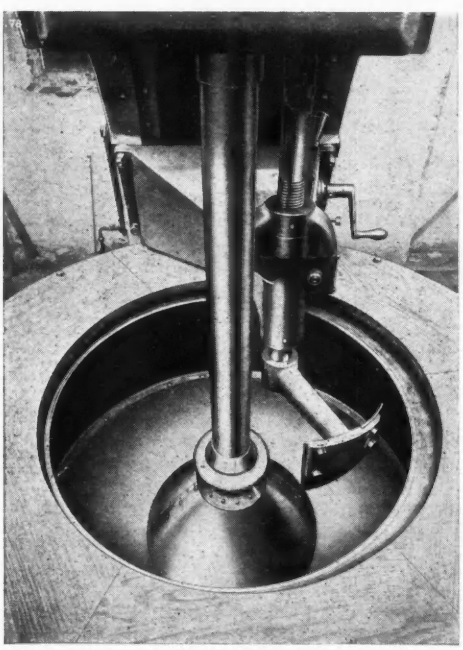
A New Range of Motorised Valves

A NEW range of motorised valves has been introduced by The Rheostatic Co., Ltd., the motor used for these valves embodies many new features and improvements, including greatly increased power, absolutely silent running, self-aligning and self-oiling bearings. The electrical circuit has been designed so that the motor can be stalled for an indefinite period without damage occurring. A selector switch is incorporated, this being geared to the slow-speed shaft and arranged to switch off the motor when it has responded to the demands of the remote switch or thermostat. An additional make-and-break switch is also provided for more complete heating schemes.



The Satchwell motorised butterfly valve type PMV made by the Rheostatic Co., Ltd.

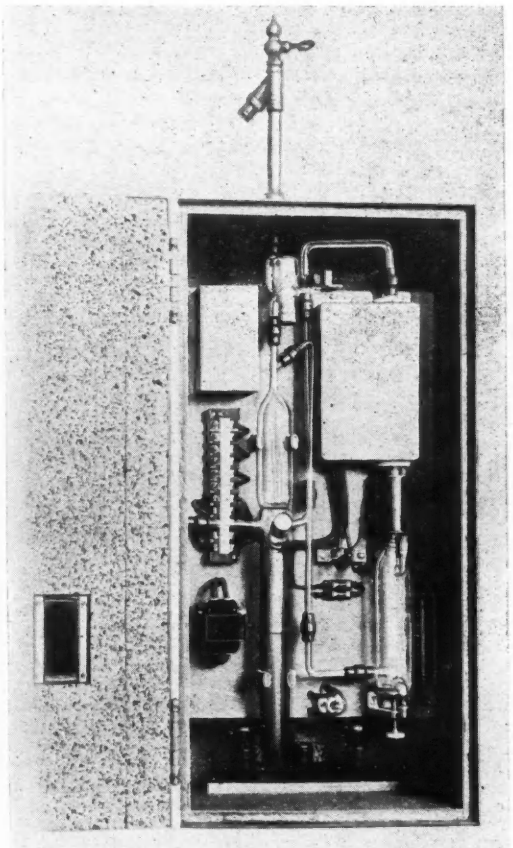
New Centrifugal Plough



A new type of plough fitted to a centrifugal machine made by Thomas Broadbent and Sons, Ltd. It enables crystalline and granular products to be very rapidly discharged. The plough can be moved vertically and horizontally by means of hand-operated levers, and it scrapes off the whole of the centrifuged product deposited against the periphery of the basket.

Recording CO_2 in Flue Gases

THE Kent Multelec CO_2 recorder (George Kent, Ltd.) is based on the thermal conductivity principle. The recorder is the standard potentiometric Multelec instrument which can either be panel mounted or wall mounted at any convenient distance from the primary element. The response of the instrument to any change in CO_2 percentage is instantaneous, and the time lag associated with many CO_2 instruments is positively eliminated. The apparatus is "all mains" operated; only one power connection is required for the complete equipment. Automatic voltage regulation and temperature compensation are both provided, and ambient temperature effects are guarded against by an insulated and thermostatically controlled cabinet. Two stage filtering ensures a perfect sample, two-point sample flow control allows that the correct quantity of gas passes the measuring cell, and a glass coated cell gives immunity from corrosion. The gases are saturated at a constant temperature and are therefore unaffected by the quantity of water vapour in the sample. Maintenance is practically negligible, as the only attention is an occasional topping up with water.



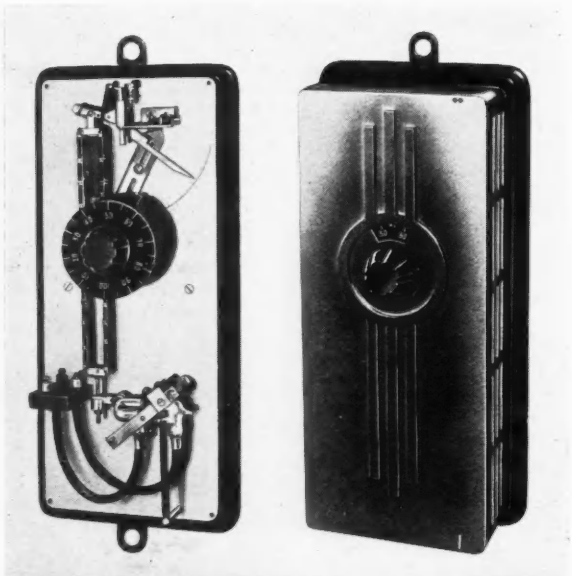
Primary element of the thermal conductivity type for CO_2 measurement by the Multelec Method.

Some Advantages

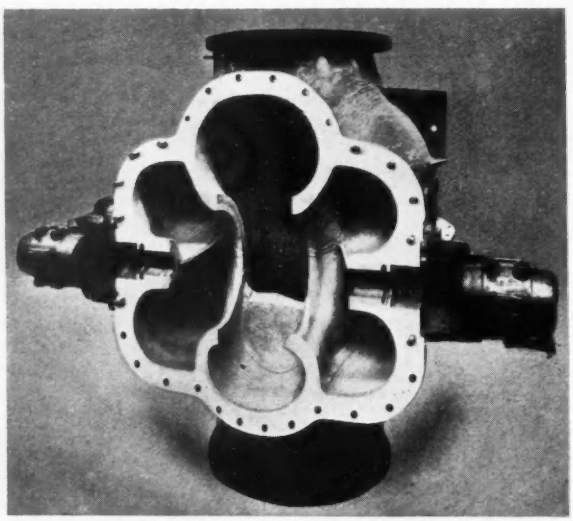
There are several features in the recording instrument which are a distinct advantage in measuring CO_2. The potentiometric principle possesses the advantage of indifference to lead resistance, which permits the use of any length of cable without the need for special balancing or matching. Superior accuracy is obtained by the use of the null principle, in which the reading cannot be affected by galvanometer characteristics, since the coils, and not the galvanometer, form the measuring element. In addition, a very clear record is obtained on the 10-inch chart, which is 120 feet long and runs continuously at a constant speed for two months.

Fireproof Panelling Board

KIMOLOBOARD fireproof panelling board, which is a new product of Cellactite and British Uralite, Ltd., embodies a real technical advance in fire resistance. This panelling board is a diatomaceous earth product combined with asbestos. A recent test by the method prescribed for the British Standards Specification proved conclusively that sheets of Kimoloboard are incombustible. On the question of rigidity the makers claim that the 3/16 in. board offers more substance, strength, and stability than are present in most of the wallboards sold hitherto obtainable. Natural absorptive properties, moreover, make it ideal where condensation is likely to be present.



A new hygrostatic control placed on the market by the C. L. Burdick Mfg. Co. These instruments are capable of handling, without relay, currents with a volume as high as 50 amps and 500 volts, either direct or alternating. They function within plus or minus 2 per cent. RH. There are no metal contacts to become corroded. Cone fibre is employed as the hygroscopic element. This substance is very sensitive to moisture, is practically non-elastic, very constant in its reactions to moisture and has five times the linear extension of hair in its reaction to humidity.



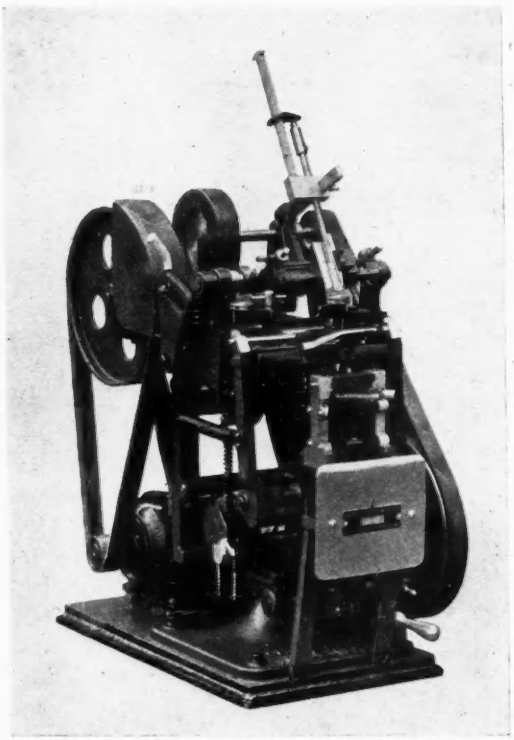
A centrifugal pump in the process of being lined with rubber by David Moseley and Sons, Ltd.

Labelling Machines

UNLESS works specialise on a certain product labelling is often a complicated problem at manufacturing chemists and laboratories, where a large variety of containers and labels is dealt with.

Hand labelling is not only a slow and costly process requiring considerable table space, and also unnecessary handling and transporting of material, but the perfect presentation of labelled containers also depends entirely on the human element. However, since it is possible to construct labelling machines for the special requirements of manufacturing chemists, viz., machines which apart from operating at speed in a clean and efficient manner, are easily adjustable to a large extent for dealing with a large variety of containers and labels, the labelling problem can be greatly simplified.

Anker Brothers and Co., Ltd., have over 30 years' experience in labelling matters, and are often consulted by manufacturing chemists to assist in labelling problems. Their machines are British-made. "Anker" labeller has adjustable construction for labelling bottles and other containers from 1 oz. up to 80 oz. content, as well as jars, boxes and cartons. The "Anker-Colibri" labeller, also an adjustable construction, is a small table model, which takes less than half-a-square yard of table space; it is driven by a 1/4 h.p. motor and has an output of about 30-35 labellings per minute. This machine operates on fragile ampoules with ½ c.c. to 50 c.c. content, small vials, bottles of all shapes, glass tubes and cartons.



The "Anker Colibri" Labeller.

THE adjusting knob of a new boiler thermostat supplied by The Rheostatic Co., Ltd., has been designed with two scales, one fitted to the face and the other on the edge. By this means the setting can be easily read and adjusted whatever the position in which the thermostat is installed. An additional feature is that a cast aluminium cover and base has replaced the old pressed metal cover, thus giving the instrument excellent protection against possible rough usage.

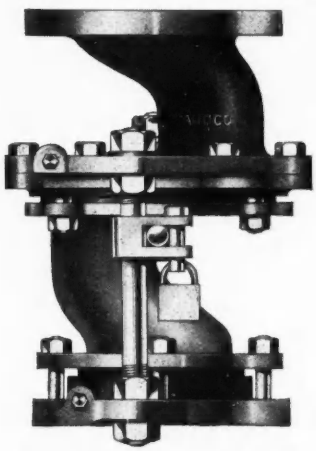
New Portable Pumping Units for Acid Handling

PORTABLE Pumping Units to suit every condition of acid handling are made by the Lennox Foundry Co., Ltd. These new pumping units are invaluable in every works or factory where chemicals are employed, either as a pumping set for regular production work or as a standby to replace other pumps undergoing repair. The pump is easily wheeled to the required position and can be connected with flexible pipe in a few minutes; the pivoted front axle allows easy management in awkward places. It wil empty store tanks, pickling tanks, sludge sumps, tank waggons, carboys, process vessels, or any other receptacle for liquid, and deliver the contents wherever required. It can handle the most difficult corrosives, such as nitric, sulphuric, acetic acid, etc., without the slightest difficulty, and even gritty substance such as chalk slurry can be pumped without fear of erosion. The pump body and impeller are cast in Tantiron or Regulus metal; the interceptor is made in lead. The impeller shaft is carried on ball-and-roller bearings, and the drive is obtained by an electric motor, petrol engine, or steam turbine, with a flexible coupling direct on to the pump shaft.

The new Lennox Rotopump, a little pump with a big performance, is made to handle acids and other highly corrosive liquids without trouble. It was designed to meet the constant demand for a small general purpose acid pump. The pump weighs only 20 lb. and is capable of working at over 35 lb. per sq. in. delivery pressure. To resist most acids and corrosive conditions the body and working parts of the pump are made either in Tantiron, or for special purposes Tantcopper is used.

A Safety Device for "Isolating" Vessels

THE "Audco" kier isolating valve, a new production of Audley Engineering Co., Ltd., has been designed with a view to fulfilling the new statutory regulations concerning equipment fitted to kier systems in which the circulation is

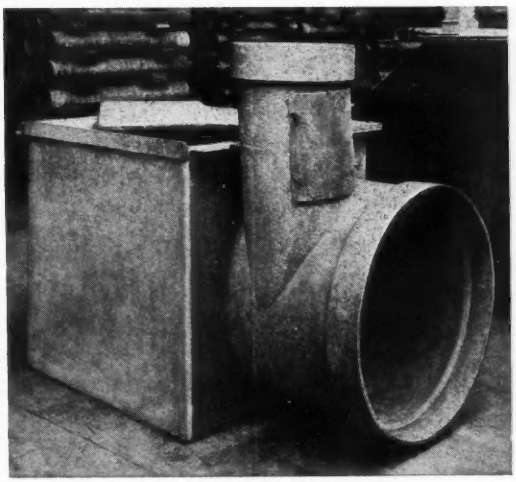


The "Audco" kier isolating valve.

effected through an external pipe. In these regulations it is now laid down that "every kier system in which the circulation is effected through an external pipe shall be provided with arrangements for disconnection of the pipe in such a way as to ensure that no liquor or water can flow into the upper part of the kier or escape from the ends of the pipe where it is disconnected."

Whilst the "Audco" kier isolating valve fulfills these conditions it is not confined to use on kiers, and may be applied with equal success on the supply side of any vessel, normally containing dangerous fluids or gases, which has to be opened periodically for cleaning, inspection or other purposes. The valve, as seen from the accompanying illustration, has two main parts which together form a continuous passageway for the fluid when the valve is in the "supply" position. The lower part is capable of rotation about a spindle which lies over the centre of the supply pipe. Both ends are effectively sealed by lubricant against leakage and, as an additional safeguard, glands are also fitted. To isolate the kier is a matter of only a few seconds: First remove the padlock, then pull the handle half-turn against stop, and finally replace the padlock. In the "isolated" position the supply pipe is unmistakably disconnected. In addition to the broken appearance of the pipe, the rotating arm is painted in contrasting colours on opposite sides to facilitate visual inspection of the valve at any time. The upper face of the rotating arm has two D-shaped openings opposite each other so that in the "isolated" position the upper passageway is to open to atmosphere. If then the pump were accidentally started with the valve in this position, and if in addition the valve itself failed to hold fluid pressure, any liquid escaping across the valve face would have to fall out to atmosphere and could not possibly find its way to the kier.

Novel Fan Extractor Chamber



A Fan Extractor Chamber in asbestos-cement, recently made by Turners Asbestos Cement Co. for one of the leading chemical firms in the country. It is believed to be quite unique and of unusual interest to the chemical industry. The extractor chamber, 2′ 10″ square, the 26″ diameter inlet duct and 12″ diameter branch duct are moulded in one piece of asbestos-cement. The material, as is well known, cannot rust or corrode, and is immune from attacks by acid fumes.

Specifications Open to Public Inspection

GAS MASKS.—Fatra Akciova Spolecnost. March 13, 1936. 20028/36.

PRODUCTION OF PHENOLIC SYNTHETIC RESINS.—Bakelite, Ltd. March 13, 1936. 20111/36.

PREPARATION OF DISUBSTITUTED AMIDES OF COUMARIN-3-CARBOXYLIC ACID.—K. Merck, L. Merck, W. Merck and F. Merck (trading as E. Merck (firm of)). March 13, 1936. 3518/37.

PRODUCTION OF IMPREGNATED SHEET MATERIALS RESEMBLING LEATHER.—Imperial Chemical Industries, Ltd. March 12, 1936. 3877/37.

PREPARATION OF AN ALKALI CYANIDE.—American Cyanamid Co. March 10, 1936. 5430/37.

METHOD FOR THE PREPARATION OF TERPENE ETHERS.—Hercules Powder Co. March 7, 1936. 5482/37.

PROCESS FOR THE CONVERSION OF OLEFINES.—Universal Oil Products Co. March 11, 1936. 5731/37.

PROCESS FOR PRODUCING LUBRICATING-OILS, INSULATING OILS, AND THE LIKE.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. March 13, 1936. 6631/37.

OBTAINING THE ANTINEURITIC VITAMIN.—L. R. Cerecedo. March 7, 1936. 6722/37.

Personal Notes

M. BACHALARD has been awarded the Coignet Prize of the French Society of Civil Engineers for his work on the oxidation of sulphur dioxide with the aid of vanadium catalyst.

MR. ALFRED EDWIN ALCOCK, until recently general works manager of the Cleveland Works of Dorman, Long and Co., Ltd., died at his home at Saltburn, last week. He was 63 and had been with the company for 27 years.

LORD FORTEVIOT has been appointed chairman of the Distillers Co., Ltd., in succession to the late Mr. Thomas Herd. He is a director of Buchanan-Dewar, Ltd., John Dewar and Sons, Ltd., and W. P. Lowrie and Co., Ltd., an extraordinary director of the Bank of Scotland, and a director of the Royal Exchange Assurance.

MR. WILLIAM MATTHEW LAYCOCK, proprietor of William Laycock and Sons, Ltd., chemical manufacturers, of William Street, Ashton-under-Lyne, was married at Worsley Parish Church on September 11, to Miss Muriel Mary Munton Billington, daughter of Mrs. and the late Alderman George Billington, of Worsley. Mr. Laycock is also a director of Laycock's (Ashton-under-Lyne) Ltd., glue and gelatine manufacturers.

EMERITUS PROFESSOR H. S. HELE-SHAW, who originated the stream-line filter, was presented with a silver loving-cup at Olympia on September 16, on the occasion of his retiring from the chairmanship of the honorary committee of experts to the Engineering and Marine Exhibition. Engineer Vice-Admiral Sir Harold A. Brown, who made the presentation at the luncheon which always takes place at the opening of the exhibition, congratulated Professor Hele-Shaw on his thirty years' work for the exhibition.

MR. H. G. REISS, well known as a mining engineer on the Gold Coast, is now on a visit to Cornwall to examine the prevailing conditions of mining tin ores.

MR. WILLIAM DIAMOND, manager for 30 years of the Marley Hill Chemical Works belonging to John Bowes and Partners, Ltd., has been transferred to the company's Monkton, Hebburn, plant in a similar capacity.

MR. SQUIRE TAYLOR, of Ainsworth Hall, Ainsworth, Lancashire, director of J. Spencer Ashworth, chemical manufacturers, Radcliffe, Lancashire, has left estate valued at £1,831, with net personalty £1,391.

MRS. SEAN T. O'KELLY, wife of the Irish Free State Minister for Local Government, has been appointed analyst to the Rathdown Board of Assistance, having sent in her application under her maiden name, Miss Phyllis Ryan. The appointment gave rise to dissension among members of the Board.

MR. W. R. GORDON, director of the Coal Utilization Council, has resigned. Some months ago he drew up plans for the expansion of the council's work, which contemplated a much larger expenditure. The plans were approved in principle by the council, which was faced with the problem of raising additional revenue.

OBITUARY

MR. HARRY ARMYTAGE, of Bare, formerly in business as a chemical manufacturer at Cleckheaton, from which he retired 13 years ago, died on September 10 at the age of 73.

MR. JAMES HERBERT SILLITOE, commercial manager of the Manchester Corporation Gas Department, has died at his home at Chorlton-cum-Hardy, Manchester, aged 52.

Chemical Notes from Foreign Sources

Bulgaria

SUNFLOWER OIL PRODUCTION has increased considerably, the yield of seed in the past year being reported at 181,000 tons as compared with an average figure of 75,000 tons during the years 1930-34. An interesting development is the impending construction of a sunflower oil-hardening plant by the Kostinbrod Co., for Chemical Products.

Czechoslovakia

THE IMPORTANCE OF SYNTHETIC RUBBER for the purpose of defence has been stressed in the 1936 reports of the leading alcohol-producing firms. In spite of the considerable sums devoted to development work in the past year, however, the problem of synthetic rubber manufacture has not been entirely solved, although there is little doubt that Czechoslovakian alcohol alone will enter into consideration as the raw material.

France

A PLANT FOR BUTANE MANUFACTURE was recently started up by the Société Générale des Huiles de Petrole.

A PRODUCT IN POWDER FORM for combating the Colorado beetle has been introduced by the "Fly-Tox" Co., under the name of "Agri-Tox."

MANUFACTURE OF GAS MASKS will be undertaken by the Société d'Exploitation Rousseau (capital 100,000 francs) of 48, rue du Temple, Paris.

MAGNESIUM OXYCHLORIDE IN POWDER FORM can be prepared by slowly heating powdered magnesia with the hydrates of magnesium chloride at a temperature in the vicinity of the point of fusion of the latter. The operation is best carried out in a rotating tubular furnace. Utilising the hexahydrate of magnesium chloride, the most favourable temperature for the reaction is 130° to 150° C. (French Patent 810,567.)

Norway

THE FIRST NORWEGIAN SYNTHETIC TEXTILE FACTORY, at Notodden, is now in regular production. Of the estimated annual output of 150 tons rayon and 300 tons staple fibre, about 30 per cent. will be required to cover the home demand

Poland

EXPLOITATION OF BARYTES DEPOSITS in the Kielce district is to be undertaken by the firm of Jan Nowacki, recently registered at Kielce. It is intended to market barytes in lump and powder form as well as in a chemically-purified quality (98.8 per cent.).

Russia

THE CULTIVATION OF ROSE TREES for perfume extraction is in progress in the Crimea, where 350 hectares are being planted. Improvements in the methods of distillation have also been introduced in the last few years so that a yield of 450 grams of rose oil is now obtained from each ton of rose flowers as compared with the present average Bulgarian yield of 300 to 350 grams.

Holland

ABSOLUTE ALCOHOL IS NOW MANUFACTURED by the Nanyo Kohatsu K.K.

SATISFACTORY ARRANGEMENTS HAVE BEEN MADE for the delivery of textile casein to the Snia Viscosa over a period of years by the Dutch dairy industry.

A NICKEL REFINERY with an annual capacity of 2,000 tons pure nickel has been built in Hyogo Province by the Showa Kogyo K.K.

CONSTRUCTION OF A CARBON DISULPHIDE WORKS is announced by the Nippon Soda K.K., with an estimated monthly output of 360 tons.

From Week to Week

PRODUCTION OF MINERAL OIL IN IRAN for July amounted to 939,000 tons, making 5,688,000 tons for first seven months of 1937.

THE WIDE DIFFERENCE which exists between the colour of uncorrected artificial light and daylight is emphasised in a booklet of Restlight, Ltd., which shows various types of industrial lighting units.

ANOTHER BOREHOLE IN SEARCH OF OIL has been commenced in Derbyshire by Steel Bros., who carry on the business of East India merchants and rice millers, and act as managing agents for the Attock Oil Co.

STOCKTON CHEMICAL ENGINEERS AND RILEY BOILERS, LTD., of Perseverance Boiler Works, Stockton-on-Tees, have increased their capital by the addition of £10,000 in £1 ordinary shares, beyond the registered capital of £12,500.

BOMBS DROPPED by aeroplanes started fire at Lever Brothers' soap factory, in the eastern district of the International Settlement, Shanghai, on September 18. It is understood that the fire was restricted to the warehouse and that no plant was damaged.

DR. E. L. BURGIN, Minister of Transport, was the principal guest at the annual dinner of the Institute of Welding, which was held at Grosvenor House on Tuesday night under the presidency of Sir William Lark. Among those present was Dr. W. Cullen (president, Institution of Chemical Engineers).

AN ILLUSTRATED BROCHURE, showing the immense variety and range of products assembled in London and Birmingham for the British Industries Fair, will shortly be distributed to importers in more than one hundred Empire and foreign markets. This guide is printed in nine languages and gives all the relevant facts relating to the 1938 Fair.

THE FOUNDATION STONE OF THE L.M.S. RAILWAY SCHOOL OF TRANSPORT at Osmaston Park, Derby, was laid by Sir Josiah Stamp, chairman of the company, on September 22. The school is to be a residential centre for the training of the staff in the best practices of railway transport work. The principal is Colonel Lionel Manton.

A MEETING OF THE HOLDERS of the 4 per cent. redeemable debenture stock of Pease and Partners, Ltd., was called on September 23, for the purpose of considering a resolution that the company shall be at liberty at any time to redeem the whole or any part of the stock for the time being outstanding on giving not less than three months' notice.

NEGOTIATIONS ARE IN PROGRESS between the Irish Free State Department of Industry and Commerce and Procea, Ltd., Dublin, starch manufacturers, regarding the erection of a factory at Longford for the production of 7,000 tons per annum of starch and glucose. It is understood that Corn Products, Ltd., the large English glucose concern, would be prepared to join in the project.

TAPS AND COCKS MADE OF HATHERNWARE CHEMICAL STONEWARE are described and illustrated in a new catalogue issued by Hathernware, Ltd. These taps and cocks are made to fit all types of stoneware plant, they are also used for tanks and pipelines of lead, iron and rubber, or attached to wood vats. They provide a clean and permanent method of handling acids and corrosive liquids.

EXPERIMENTS IN THE GROWING OF THE SOYA BEAN are in progress at the Quinton nurseries of the Birmingham Corporation, where a crop is now reaching maturity. The experiments were started last year at the suggestion of the British Soya Bean Growers' Research and Development Society, but were not successful. The present crop, however, is considered to be very satisfactory. The Birmingham Parks Committee have half an acre under cultivation. It is stated that the cost of sowing is under £4 per acre, and that the yield in seeds alone should be over £100 per acre.

THE ESTABLISHMENT OF AN INFORMATION BUREAU on special steels is announced by the Brymbo Steel Co., of Brymbo, near Wrexham. This bureau, which is a feature of the recent organisation of the Brymbo works, will be in charge of Mr. T. Roberts, who is chief metallurgist to the company. The Brymbo works were founded in 1798, and the company have been pioneers in the development of certain aspects of the specialised steel industry. The new information bureau is to assist all intending users of high-grade steels for specific purposes, including steels used in the chemical industry.

RICHARD KLINGER, LTD., announce that the quality of their well-known "Klingerit" compressed asbestos jointing has been considerably improved, and it is now not only suitable for saturated and superheated steam, water, gases, and chemicals, but is also oil-resisting. This has enabled the company to discontinue the manufacture of their special oil-resisting jointing "Klinger-Oilit," and in future they will only supply the one quality of "Klingerit" jointing for all purposes. This progressive step has met with the approval of their most important customers.

DAMAGE ESTIMATED AT £12,000 was caused by a fire at the Whitefield Works of Lawe's Chemical Co., Ltd., Govan, Glasgow, on September 16.

THE OFFICE OF THE AMERICAN COMMERCIAL ATTACHE has been moved to 1 Grosvenor Square, London, W.1, as from September 25. Telephone: Grosvenor 4111.

MANY OLD LEAD MINES IN DERBYSHIRE, Wales and Scotland, which have been idle for years, are being worked again owing to the rising price of ore following the world demand for metal.

THREE MEN ACCUSED OF CONSPIRING to defraud Mr. Harry Goodwin Hart, a former director of Unilever, Ltd., of securities and money were found guilty at the Old Bailey on September 21.

THE CALICO PRINTERS' ASSOCIATION are now erecting two mills in India in association with English and Indian partners, stated Mr. Lennox Lee, in his speech at a meeting of the association on September 15.

THE OFFICE FOR GERMAN RAW AND INDUSTRIAL MATERIALS has ordered an organised chestnut harvest, which will be collected through schools and specially instituted central depôts. It is proposed to convert the chestnuts into "raw materials" by recently discovered processes.

THE ANGLO-AMERICAN OIL CO. have abandoned their attempt to find oil at Hellingly, in Sussex, and are moving their 325 tons of machinery to Dalkeith, in Scotland. The Hellingly bore, which was the company's first attempt to find oil in Britain, was officially set in motion by Lord Apsley on June 4.

THE ROYAL TECHNICAL COLLEGE, GLASGOW, has just published its calendar for the 142nd session, 1937-38. Several systematic courses of instruction are given in both inorganic and organic chemistry, including fuels and their application, oils and fats, paints and varnish, dyeing and bleaching, and sugar manufacture.

A REPRESENTATION HAS BEEN MADE to the Board of Trade under Section 10 (5) of the Finance Act, 1926, regarding R. mannite. Any communication should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from September 20, 1937.

AFTER CONSULTING WITH THE INSTITUTION OF CHEMICAL ENGINEERS, the authorities of the Liverpool Central Technical College have decided to offer an abridged course to evening students who desire to qualify for the examinations of the institution. The specialist lecturers employed are Dr. J. R. Brown and Mr. E. Woolatt.

BOWEN INSTRUMENT CO. have recently had one of their temperature controllers under test at the Ford Motor Works, in comparison with a competitor of excellent repute, and the results have been fully satisfactory. They make electrical pyrometers for indicating and recording of the resistance, thermoelectric, radiation, and optical types for all temperature ranges and applications.

A SERIOUS FIRE BROKE OUT at the Rockvilla Oil Works, Dawson Road, Possilpark, Glasgow, on September 18. The fire originated in a cotton-seed store, a three-storey building which belongs to Messrs. Pearson, Beckitt and Co., a branch of the British Oil and Cake Mills, Ltd. The damage is estimated at many thousands of pounds. Nearly 800 tons of cotton seed are believed to have been destroyed.

THE BRITISH STEELWORK ASSOCIATION has removed from Artillery House, Artillery Row, Victoria Street, to Steel House, Tothill Street, Westminster. The Association was formerly the body charged with finding new uses for steel and making these applications public. Recently it became merged in the British Constructional Steelwork Association, the official organisation of the structural engineering industry affiliated to the British Iron and Steel Federation.

GERMAN IMPORTS IN AUGUST showed a seasonal decline of 18,000,000 marks, or 4 per cent., compared with July, but at a total of 482,000,000 m. they were still 136,000,000 m. higher than in August last year. Exports in August rose by 2 per cent. compared with July to a total of 541,000,000 m. Raw materials, including hard coals and nitrates, accounted for 3,600,000 m. of the increase in exports. Exports of heavy iron products fell by 8,000,000 m., and of chemicals by 3,100,000 m.

IN VIEW OF THE HOSTILITIES IN CHINA, more particularly in the Shanghai area, the Federation of British Industries has decided to convene a meeting of certain firms with large interests in that country to consider the situation with a view to a common policy for the protection of their properties, and the lodging of claims at the proper time, as well as the general safeguarding of British interests. The meeting, which will be held jointly with the China Association in London, will take place at the offices of the Federation on September 29. The Bradford and Manchester Chambers of Commerce are sending representatives to the meeting.

Weekly Prices of British Chemical Products

THERE have been no outstanding movements in the markets for general heavy chemicals during the past week, and a quiet tone prevails throughout. Deliveries under existing commitments appear to be taken up with fair regularity, but buyers are reluctant to enter into fresh business. The price of red lead has been reduced by £2 per ton, but there are no other price alterations to record. In acids, acetic, tartaric and citric are in the usual demand, and a steady trade is being put through for most of the potash and soda items. In rubber chemicals, lithopone is firm for a steady trade. Conditions in the coal tar section pursue pretty much the same trend as of late, and a number of products continue to be difficult to negotiate for spot. Carbolic acid crystals and creosote oil are firm and active, and immediate supplies of the former item are scarce. An active interest is displayed in cresylic acid, and a good forward business is being done in anticipation of supplies being easier during 1938. Solvent naphthas are inclined to be a little dearer on a good demand, and xylol and toluol are both firm on quotation. Elsewhere prices are steady with a firm undertone.

GLASGOW.—Business in general chemicals has been rather quieter during the week, both for home trade and export. Prices, however, continue very firm at about previous figures, with the exception of lead and copper products, which are lower on account of the fall in metal prices. Red lead has been reduced £1 per ton. Conditions continue very steady on the coal tar by-products market with no noteworthy price changes to report. Present production in this district is fairly well covered by existing contracts, and manufacturers' quotations for supplies into next year are on a very firm basis. The amount of fresh business arranged so far, however, is limited, and in certain sections it is a matter of speculation as to whether present values will hold. With benzole, carbolic acid, creosote and pyridine, the position is strong, while in the case of cresylic acids, pitch and export refined tar, inquiries are numerous, but the demand slow.

MANCHESTER.—Steady to firm price conditions pretty well throughout the entire range of heavy chemical products have been in evidence on the Manchester market during the past week. Whilst traders generally on this centre report no more than a moderate volume of fresh business going through, a satisfactory feature is that deliveries against contracts in respect of most classes of chemicals are on a fairly active scale. Textile finishing and dyeing materials meet with a steady demand, and in other directions also the alkali products and the heavy acids, as well as the potash compounds, are being called for in fair quantities. Somewhat quiet trading conditions have been reported this week in several sections of the by-products market locally, although here also good quantities are being taken up against old commitments. Carbolic acid and pyridine are still particularly firm.

General Chemicals

ACETONE.—£45 to £47 per ton.

ACETIC ACID.—Tech., 80%, £28 5s. per ton; pure 80%, £30 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 per ton d/d Lancs.; GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders. SCOTLAND: 10½d. to 1s. 0½d., containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—Grey galvanising, £17 10s. per ton, ex wharf.

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM DICHROMATE.—8d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11 per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish £17 10s., ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £11 5s. per ton.

BLEACHING POWDER.—Spot, 35/37%, £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CHROMETAN.—Crystals, 2¾d. per lb.; liquor, £19 10s. per ton d/d. station in drums. GLASGOW: 70/75% solid, £5 15s. per ton net ex store.

CHROMIC ACID.—9¼d. per lb., less 2½%; d/d U.K.

CITRIC ACID.—1s. per lb. MANCHESTER: 1s. SCOTLAND: B.P. crystals, 1s. per lb., less 5%, ex store.

COPPER SULPHATE.—£21 7s. 6d. per ton, less 2% in casks. MANCHESTER: £22 10s. per ton f.o.b. SCOTLAND: £24 per ton, less 5%, Liverpool, in casks.

CREAM OF TARTAR.—100%, 92s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£22 10s. per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £5 7s. 6d. to £6 7s. 6d. per cwt. according to quantity; in drums, £5 to £5 13s. 6d.

HYDROCHLORIC ACID.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 4d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots) Dark, 50% by volume, £23 10s.; by weight, £27 10s.; Pale, 50% by volume, £27; by weight, £32 per ton. LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One-ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. GLASGOW: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £35 10s.

LEAD NITRATE.—£39 per ton.

LEAD, RED.—£35 15s. per ton, less 2½% carriage paid. SCOTLAND: £35 per ton, less 2½%, carriage paid for 2-ton lots.

LITHARGE.—SCOTLAND: Ground, £35 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 10s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 11d per lb.; powder B.P., 6s. 1d.; bichloride B.P. (corros. sub.) 5s. 2d.; powder B.P. 4s. 10d.; chloride B.P. (calomel), 5s. 11d.; red oxide cryst. (red precip.), 7s.; levig. 6s. 6d.; yellow oxide B.P. 6s. 4d.; persulphate white B.P.C., 6s. 1d.; sulphide black (hyd. sulph. cum sulph. 50%), 6s. For quantities under 112 lb., 1d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NITRIC ACID.—80° Tw. spot, £16 10s. per ton makers' works.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

PARAFFIN WAX.—SCOTLAND: 3¾d. per lb.

POTASH CAUSTIC.—Solid, £35 5s. to £36 15s. per ton for 2-ton lots ex store; broken, £42 per ton. MANCHESTER: £39.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4¼d. per lb. MANCHESTER: £38 per ton.

POTASSIUM DICHROMATE.—SCOTLAND: 5d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 5s. 6d. per lb. in 7 lb. lots.

POTASSIUM NITRATE.—£27 per ton. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¾d. per lb. SCOTLAND: B.P. Crystals, 9¾d. MANCHESTER: B.P. 11d. to 1s.

POTASSIUM PRUSSIATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d.

SALAMMONIAC.—Dog-tooth crystals, £36 per ton, fine white crystals, £16 10s. per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37.

SALT CAKE.—Unground, spot, £3 to £3 10s. per ton.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £18 10s. in drums, £19 5s. in casks, Solid 76/77° £15 12s. 6d. in drums; 70/73%, £15 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts, 10s. per ton less.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£18 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. GLASGOW: £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags. MANCHESTER: £10 10s.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.
SODIUM CARBONATE MONOHYDRATE.—£15 5s. per ton d/d in minimum ton lots in 2 cwt. free bags.
SODIUM CHLORATE.—£26 10s. to £30 per ton. GLASGOW: £1 10s. per cwt., minimum 3 cwt. lots.
SODIUM CHROMATE.—4d. per lb. d/d U.K.
SODIUM DICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. MANCHESTER: 4d. per lb. GLASGOW: 4d., net, carriage paid.
SODIUM HYPOSULPHITE.—Pea crystals, £14 10s. per ton for 2-ton lots; commercial, £10 5s. per ton. MANCHESTER: Commercial, £10; photographic, £14 10s.
SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, 9¼d. per lb. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—£10 10s. to £11 per ton delivered (Di-basic).
SODIUM PRUSSIATE.—4d. per lb. for ton lots. GLASGOW: 5d. to 5⅜d. ex store. MANCHESTER: 4d. to 4¾d.
SODIUM SILICATE.—£9 10s. per ton.
SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 12s. 6d.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 10s.
SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d sta- of 5 cwt. and upwards. MANCHESTER: 1s. 1¼d. per lb.
SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.
TARTARIC ACID.—1s. 1¼d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1¼d. per lb. GLASGOW: 1s. 1d. per lb.
ZINC SULPHATE.—Crystals, £9 per ton, f.o.r., in bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb., according to quality. Crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality
ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £6 10s. per ton, according to quality.
CADMIUM SULPHIDE.—7s. 8d. to 7s. 11d. per lb.
CARBON BLACK.—4½d. per lb., ex store.
CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.
CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 1s. 2d. per lb.
DIPHENYLGUANIDINE.—2s. 2d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 4¾d. to 5½d. per lb.; dark 4d. to 4½d. per lb.
LAMP BLACK.—£22 to £23 per ton d/d London; vegetable black, £28 to £48.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE.—30%, £16 10s. to £17 5s. per ton.
SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.
VERMILLION.—Pale, or deep, 5s. 3d. per lb., 1-cwt. lots.
ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6 = nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1938: September, 1937, £7 5s. per ton; October, £7 6s. 6d.; November, £7 8s.; December, £7 9s. 6d.; January, 1938, £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.
CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1938: September, 1937, £7 7s. 6d. per ton; October, £7 8s. 9d.; November, £7 10s.; December, £7 11s. 3d.; January, 1938, £7 12s. 6d.; February, £7 13s. 9d.; March, £7 15s.; April/June, £7 16s. 3d.
NITRO CHALK.—£7 10s. 6d. per ton for delivery up to June 30, 1938.
SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1938.
CONCENTRATED COMPLETE FERTILISERS.—£10 12s. to £11 1s. per ton for delivery up to September 30, in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 5s. to £13 5s. per ton for delivery up to September 30, in 6-ton lots to farmer's nearest station.

Coal Tar Products

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor, 1s. 3d. to 1s. 3½d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 8d. to 1s. 8½d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 4d. to 1s. 4½d.
CARBOLIC ACID.—Crystals, 7½d. to 8½d. per lb., small quantities would be dearer; Crude, 60's, 4s. to 4s. 3d., dehydrated, 4s. 6d. to 4s. 9d. per gal. MANCHESTER: Crystals, 10½d. per lb. f.o.b. in drums; crude, 4s. 4d. to 4s. 6d. per gal. GLASGOW: Crude, 60's, 4s. 3d. to 4s. 6d. per gal.; distilled, 60's
CREOSOTE.—Home trade, 6¼d. to 6⅜d. per gal., f.o.r. makers' works; exports, 6⅜d. to 6⅝d. per gal., according to grade. MANCHESTER: 5¼d. to 6¼d. GLASGOW: B.S.I. Specification, 6d. to 6½d. per gal.; washed oil, 5d. to 5½d.; lower sp. gr. oils, 5⅜d. to 6¼d.
CRESYLIC ACID.—97/99%, 4s. 9d. to 5s.; 99/100%, 5s. to 5s. 3d. per gal., according to specification; Pale, 98/100%, 5s. per gal.; Dark, 95%, 4s. 6d. to 4s. 8d. per gal. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. 3d. to 4s. 6d.; high boiling acids, 2s. to 2s. 6d. American specification, 4s. 3d. to 4s. 6d. MANCHESTER: Pale, 99/100%, 4s. 11d.
NAPHTHA.—Solvent, 90/160%, 1s. 8d. to 1s. 9d. per gal., naked at works; heavy 90/190%, 1s. 2d. to 1s. 3d. per gal., naked at works, according to quantity. GLASGOW: Crude, 6½d. to 7½d. per gal.; 90% 160, 1s. 5d. to 1s. 6d., 90% 190, 1s. 1d. to 1s. 3d.
NAPHTHALENE.—Crude, whizzed or hot pressed, £9 to £9 10s. per ton; purified crystals, £18 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 10s. to £7 per ton. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £20 per ton f.o.b.
PITCH.—Medium, soft, 39s. per ton, f.o.b. MANCHESTER: 37s. 6d. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 35s. to 37s. per ton; in bulk for home trade, 35s.
PYRIDINE.—90/140%, 12s. 6d. per gal.; 90/160%, 10s. per gal.; 90/180%, 5s. per gal., f.o.b. GLASGOW: 90% 140, 10s. to 12s. per gal.; 90% 160, 9s. to 10s.; 90% 180, 2s. 6d. to 3s. MANCHESTER: 11s. to 12s. per gal.
TOLUOL.—90%, 2s. per gal.; pure, 2s. 5d. GLASGOW: 90%, 120, 1s. 10d. to 2s. per gal.
XYLOL.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d. to 2s. 6d. according to quantity. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £8 to £8 10s. per ton; grey, £10 10s. to £11 10s. Liquor, brown, 30° Tw., 6d. to 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11 10s.
CHARCOAL.—£6 10s. to £12 per ton, according to grade and locality.
METHYL ACETONE.—40-50%, £42 to £45 per ton.
WOOD CREOSOTE.—Unrefined 6d. to 9d. per gal., according to boiling range.
WOOD, NAPHTHA, MISCIBLE.—2s. 8d. to 3s. 3d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.
WOOD TAR.—£3 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.
BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.
m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-CRESOL, 34-5° C.—1s. 7d. to is. 8d. per lb. in ton lots.
DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—7½d. per lb.
DINITROCHLORBENZENE, SOLID.—£72 per ton.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 10d.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works
GAMMA ACID.—Spot, 4s. per lb. 100% d/d buyer's works.
H ACID.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
NAPHTHIONIC ACID.—1s. 8d. per lb.
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—9½d. to 9⅝d. per lb.; flake, 9¼d. to 9¾d.
a-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.
NEVILLE AND WINTHER'S ACID.—Spot, 3s. per lb. 100%.
o-NITRANILINE.—3s. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.
SULPHANILIC ACID.—Spot, 8d. per lb. 100%, d/d buyer's works.
o-TOLUIDINE.—10½d. per lb., in 8/10-cwt. drums, drums extra.
p-TOLUIDINE.—1s. 10½d. per lb., in casks.
m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, Sept. 22.—LINSEED OIL was steady. Spot, £32 5s. per ton (small quantities), Oct. to Dec., £29 12s. 6d.; Jan. to Dec., £29 10s., naked. SOYA BEAN OIL was steady. Oriental, spot, ex tank Rotterdam, £23 per ton. RAPE OIL was quiet. Crude extracted, £37 per ton; technical refined, £38, naked, ex wharf. COTTON OIL was dull. Egyptian crude, £23 per ton; refined common edible, £27; deodorised, £29, naked, ex mill (small lots £1 10s. extra). TURPENTINE was quiet. American, spot, 35s. per cwt.

HULL.—LINSEED OIL.—Spot, quoted £30 10s. per ton; Sept., £29 17s. 6d.; Oct., £29 15s.; Nov.-Dec., £29 17s. 6d.; Jan.-April and May-Aug., £29 10s. COTTON OIL.—Egyptian crude, spot, £21 per ton; edible, refined, spot, £24; technical, spot, £24; deodorised, £26, naked. PALM KERNEL OIL.—Crude, f.m.g., spot, £22 10s. per ton, naked. GROUNDNUT OIL.—Extracted, spot, £30 per ton; deodorised, £33. RAPE OIL.—Extracted, spot, £36 per ton; refined, £37. SOYA OIL.—Extracted, spot, £29 10s. per ton; deodorised, £32 10s. COD OIL.—F.o.r. or f.a.s., 27s. 6d. per cwt., in barrels.

Forthcoming Events

September 26-October 2.—16th Congress of Industrial Chemistry and 20th Anniversary of the foundation of the Society of Industrial Chemistry, Paris.

September 29.—Institute of Chemistry (London and South-Eastern Counties' Section). Discussion of the proposed supplemental charter, at the Institute, 30 Russell Square, London, W.C.1, at 7.30 p.m.

September 30-October 2.—9th Annual Conference of the National Smoke Abatement Society, at the Philisophical Hall, Leeds.

October 1.—Institute of Chemistry (Glasgow and West of Scotland Section). Annual general meeting and Tatlock memorial lecture. "The Forensic Chemist in the Criminal Courts." Dr. C. Ainsworth Mitchell.

Company News

Broom and Wade, manufacturers of air compressors, etc., has declared a dividend at the rate of 6 per cent. per annum on the preference shares, less tax.

Yorkshire Dyeing and Proofing.—The net profit for the year to June 30 last was £19,188 (£24,857); available, £26,709 (£30,221). After transferring £5,000 (£7,500) to reserve and paying ordinary dividend of 8 per cent., less tax (same), £6,509 (£7,521) goes forward.

Cheshire United Salt has announced a dividend of 3 per cent., actual, less tax (2½ per cent.), on the ordinary shares, and additional dividend of 3 per cent., less tax, on the preferred ordinary shares, making 8 per cent. (7½ per cent.) for the year ended June 30, 1937.

Dussek Brothers, oil refiners and distillers, have announced that dividend on the 6 per cent. cumulative preference shares for the half-year ending September 30 will be paid on that date to shareholders registered September 15.

International Paint and Compositions has maintained its interim dividend on the £534,500 ordinary capital at 4 per cent., less tax, in respect of the year to December 31 next, payable on September 30. Last year's interim was followed by a final of 12 per cent., making 16 per cent., less tax, for 1936, as against 14 per cent. for the previous year.

British Aluminium have resumed interims on the £2,000,000 ordinary shares, with a dividend of 4 per cent., actual, less tax, for 1937, payable on October 1. The last interim dividend was at a similar rate on account of 1930. For the year ended December 31 last a first and final dividend of 10 per cent. was paid, which was 2½ per cent. more than for 1935. The usual half-yearly distribution on the £1,500,000 6 per cent. cumulative preference shares is also announced.

Tebbitt Brothers, leather manufacturers, etc., has recommended a dividend of 3¾ per cent. actual, less tax (2½ per cent.), on the ordinary shares for year ended June 30, 1937.

Murex, which owns the patent rights of a process of ore concentration and separation, has declared a final dividend of 10 per cent. and a cash bonus if 2½ per cent., both less tax, on the increased ordinary capital of £1,000,000. This makes a total distribution of 20 per cent. actual, less tax, for the year ended June 30 last.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—The Director of Contracts, A.H.Q., Simla, invites tenders for 3,185 cwt. sulphate of ammonia (commercial). Forms of tender obtainable from the Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1, at a fee of 5s. Tenders must be sent direct to Director of Contracts, Army Headquarters, Simla, India, to reach him not later than October 18, 1937.

Egypt.—The Commercial Counsellor to H.M. Embassy in Egypt reports that the Egyptian Ministry of Public Works is calling for tenders for the supply and delivery of air-conditioning apparatus. Tenders, endorsed "Tender for Air Conditioning Rooms at Ministry of Public Works," should be addressed to the Director-General, Mechanical and Electrical Department, Ministry of Public Works, Cairo, by whom they will be received up to noon on October 20, 1937. (Ref. T. 19621/37.)

Chemical and Allied Stocks and Shares

CONDITIONS in the stock and share markets have shown no material change this week. Although in the absence of demand, prices of most usually active shares have reacted further on balance, there were indications that the lower prices were attracting more attention, and subsequently there was partial recovery from the lowest figures touched this week.

Imperial Chemical were much steadier, and although now "ex" the interim dividend, are 36s. 7½d. or virtually the same as a week ago. The higher interim of 3 per cent. has been proposed in order to bring the payment more into relation with the final distribution, but the disposition in the market is to assume there is a reasonable possibility of a larger total than last year's 8 per cent. Not more than 8½ per cent. or 9 per cent. is looked for because it is expected a large sum will again be placed to reserves. Distillers have lost several shillings and are 105s. 6d. at the time of writing, at which the yield offered would appear to be favourable as last year's dividend was 22½ per cent., and the latter was covered by a good margin of profits.

Borax Consolidated lost 1s. 3d. to 30s., awaiting the decision as to an interim dividend, which is expected shortly. Boots Pure Drug have declined from 52s. 9d. to 50s. 6d. at the time of writing, but this was attributed entirely to general market conditions, as it is confidently expected there will be no change in the distribution, while the assumption in many quarters is that, in view of the exceptionally strong balance sheet, there is the possibility of a scrip bonus in the future. Timothy Whites and Taylors were fairly steady around 33s. 3d., aided by hopes of a larger dividend. Sangers kept at 24s. 9d. British Aluminium are 52s., compared with 53s. 9d. a week ago, but at one time the price was down to 50s. The market remains hopeful that if an increase in capital is made it may take the form of an offer of shares to shareholders. Resumption of payment of an interim dividend suggests the company is continuing to make good progress.

General Refractories have gone back from 28s. to 26s. 6d., although in view of the fact that the interim dividend was raised recently from 6 per cent. to 8 per cent., the disposition is to budget for a higher total dividend, there being hopes of 18 per cent., compared with the previous year's 16 per cent. Triplex Safety Glass have fluctuated rather sharply and at 57s. 6d. show a decline of 2s. 6d. on the week. As the dividend on these 10s. shares was 35 per cent. for the past year, the yield offered appears rather on the generous side. United Glass Bottle and other shares of glass manufacturing companies were little changed. Associated Portland Cement were reactionary and have declined from 90s. to 86s. 3d. despite expectations that the impending interim dividend will be maintained. British Plaster Board at 30s. have remained around the lower price made last week; the interim dividend on these 5s. shares also falls to be announced shortly.

Fison, Packard at 38s. 9d. are within a few pence of the price ruling a week ago, awaiting the past year's results. B. Laporte lost 2s. 6d. to 105s., but the amount of business was probably not sufficient to test the price adequately. Imperial Smelting have been lowered from 16s. 9d. to 15s. 4½d., the market now being less hopeful that dividends may be resumed this year. British Glues and Chemicals kept around 7s. 6d. and British Industrial Plastics around 3s. Monsanto Chemicals preference were 23s. 3d. and Greeff Chemicals Holdings 5s. units little changed at 7s. 6d. British Drug Houses were around 23s.

Staveley Coal and Iron shares were steady on the full results and Stewarts and Lloyds were assisted to some extent by current market dividend estimates, which range from 9 per cent. to 12½ per cent. Consett Iron were little changed, but Dorman Long were lower, although the market is expecting a favourable increase in the dividend of the last-named company.

Shell, Anglo-Iranian and other leading oil shares were again lower on the week.